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of Engineers**

Southwestern Division
Tulsa District

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PINE BLUFF ARSENAL

Site 34
NCTR Equalization
Pool

Site Closure Plan

9833847



JUNE 1985

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PINE BLUFF ARSENAL

SITE 34

NCTR EQUALIZATION POND

SITE CLOSURE PLAN

DEPARTMENT OF THE ARMY

TULSA DISTRICT, CORPS OF ENGINEERS

TULSA, OKLAHOMA

JUNE 1985

PINE BLUFF ARSENAL
SITE 34
NCTR EQUALIZATION POND

SITE CLOSURE PLAN

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I

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SYNOPSIS

Site 34, the National Center for Toxicological Research (NCTR) Equalization Pond at Pine Bluff Arsenal, Arkansas, will be closed in a FY 86 Military Construction, Army (MCA) project in accordance with all applicable State and Federal regulations. The general investigative procedures followed at Site 34 were to establish the extent and nature of contamination of the pond water and waste materials both in the sediment and underlying soils. This included investigations sufficient in scope to determine the vertical and horizontal limits of contamination and to determine which contaminants would classify as hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). The contaminants found at this site are heavy metals and organic compounds from the past use of Site 34 as a flow equalizing and neutralizing area for a caustic sludge resulting from the destruction of a stock of biological agents. Contaminants are present in the pond sediments. The heavy metal contaminant concentrations are below all EP toxicity limits. Several RCRA-listed organic compounds are present in the pond sediments including naphthalene, dibenzo (a,h) anthracene Di-n-butyl phthalate and others (see section 3, table 3-3). Groundwater contamination has not been detected at the site. An off-site disposal plan which would excavate and remove the contaminated sediment (2200 cubic yards) to the proposed hazardous waste landfill is the recommended plan for closure. This closure plan has an estimated cost of \$72,800 and is considered to be technically, economically and environmentally acceptable, based on the data presented in the following narrative.

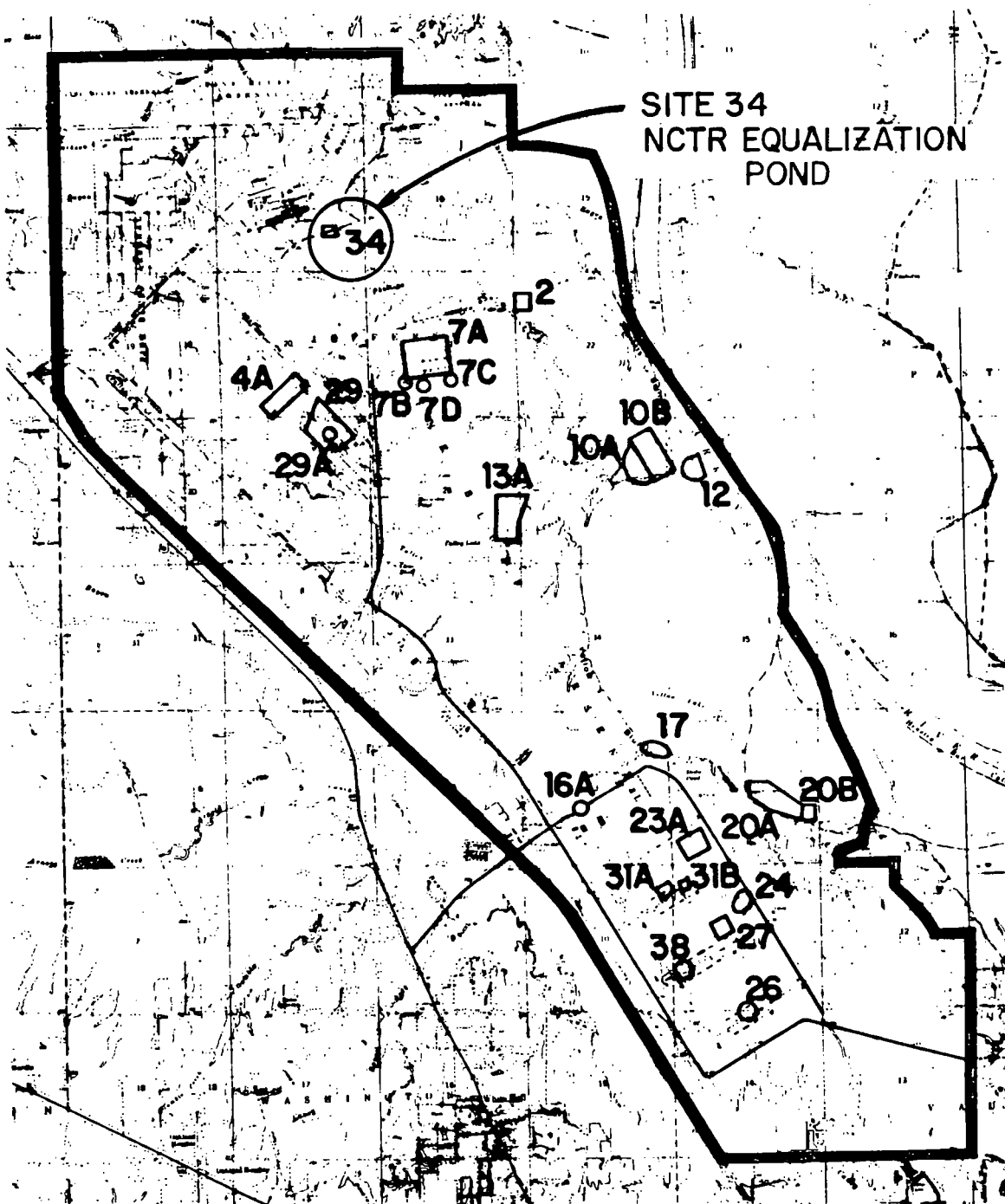
I - GENERAL

1-01 Purpose. This report presents the closure plan for contaminated waste materials located at Site 34, the NCTR Equalization Pond at Pine Bluff Arsenal, Arkansas. This site is an inactive site and will be permanently closed in accordance with applicable State and Federal regulations in order to eliminate an historical dump. Discussions between Arkansas Department of Pollution Control and Ecology (ADPCE), Tulsa District, Corps of Engineers (TDCE), and Pine Bluff Arsenal (PBA) personnel determined that remedial action must be conducted at this site in response to a consent order issued to PBA by ADPCE. It was jointly decided to use a negotiation process between the parties similar to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Criteria for hazardous waste set forth in the Resource Conservation and Recovery Act (RCRA) were used to classify materials and manage waste which became subject to RCRA during the remedial action process. Cleanup limits for RCRA-listed metal contaminants were dictated by ADPCE and related to both Total Ion and EP Toxicity Testing (see section 3, table 3-1).

1-02. Report format. A site description is presented in Section 2. The geotechnical and contaminant investigations which form the basis for the proposed closure plan are contained in Section 3. A description of the proposed closure plan for this site is presented in Section 4. The indicated closure plan is considered to be the most technically feasible, cost effective, and environmentally acceptable alternative based on the results of geotechnical investigations and existing site conditions. An alternative closure plan and comparative cost estimate for both closure plans are presented in Sections 5 and 6, respectively.

II - SITE DESCRIPTION

2-01. Site Description. Site 34, the NCTR Equalization Pond is a 1.5-acre site containing a one-quarter acre pond, a corrugated metal building (T93-820), and a 12-foot diameter holding tank (T93-822). The site is located on Wintergreen Road in the Depot area as shown on Figure 2-1. The site was first used in 1969 during the close down of the Directorate for Biological Operations (DBO) as a flow equalizing and neutralizing area for a caustic sludge resulting from the destruction of their stock of biological agents. The sludge was neutralized in the pond and the effluent then discharged through the North Sewage Treatment Plant into the North Oxidation Pond. When the National Center for Toxicological Research (NCTR) took over the facilities that had formerly housed the DBO, the Equalization Pond was used as a flow equalization chamber and settling pond for industrial sewage going to the North Sewage Treatment Plant. Its use was terminated in 1980 and the pond is no longer connected to either facility. No known toxic contaminants were introduced into the pond at any time during its use. A pump house and mixing tank are still present at the site, and the piping entering and leaving the pond is still present. The site is flat at approximate elevation 268 with the top of the pond dikes approximately 5 feet above natural ground. The water elevation in the pond is approximately 270. Grass grows with no apparent distress on and around the pond dikes. Vegetation also exists in the pond and was thick enough to necessitate its removal for collection of sediment samples. A photograph of the site is shown in the Exhibit.



**PINE BLUFF
ARSENAL
CLOSURE SITES**

FIGURE 2 - 1

III. GEOTECHNICAL AND CONTAMINANT INVESTIGATIONS

3-01. Introduction The purpose of the exploration program was to (1) determine the location and properties of any clay strata beneath the site that would be acceptable for use as a lower impermeable boundary in an insitu encapsulation scheme and (2) define the type, severity, and lateral and vertical extent of contamination.

3-02. Field Investigations Eleven auger holes ranging from 4.3 to 40 feet deep and one auger-denison hole 41.5 feet deep were drilled at Site 34 during the spring and summer of 1984 at locations shown on drawing 1. Five of these holes, 34-7 through 34-11, were drilled in the pond. Soil from the auger and denison holes was described in the field and classified in the laboratory. Each run with the auger was limited to 3 feet. To prevent mixing of materials, or sampling material that had pulled off from the wall of the hole, only the interior portion of each sample was used. Material was taken from the entire 3-foot sample, sealed in plastic or glass jars and shipped to the Corps of Engineers Southwestern Division Laboratory in Dallas. Hole 34-14 was augered to 14.1 feet and an in-situ permeability test was run at this depth. Two undisturbed denison samples from this hole were sealed and shipped to the SWD laboratory for falling head permeability tests. Holes 34-12, -13, and -14 were backfilled with grout because they penetrated a clay-shale layer.

3-03. Laboratory Testing.

a. Chemical Testing Procedures.

(1) Metals.

(a) Total ion testing. Soil samples were digested in strong acid and the resulting extracts were tested by atomic absorption spectroscopy techniques. The acid treatment resulted in total ion extraction, freeing the metals from the soil and pore water. A representative portion of the sample was oven dried and the values reported in milligrams/kilogram (mg/kg) dry weight. Tests were conducted for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver concentrations (the eight RCRA listed toxic heavy metal contaminants). In addition, zinc concentrations were determined because of its suspected presence at the site even though it is not a RCRA-listed contaminant. Groundwater samples were filtered in the lab and given a similar acid treatment. Surface water samples were not filtered in the lab and were given the same acid treatment. The results are reported in milligrams/liter (mg/l), in Appendix I.

(b) EP toxicity testing. Extraction Procedure Methodology, commonly referred to as EP toxicity testing, is a much less rigorous extraction of metals, designed to simulate typical leaching conditions in a landfill. Results are reported in mg/l (as a concentration in an extract obtained in a specified manner). Results of total ion and EP toxicity testing are reported in Appendix I.

(2) Organics. Soil, sediment, and water samples were tested by gas chromatograph/mass spectroscopy (GS/MS) techniques. Selected samples were analyzed for purgeable organics, base/neutral extractable organic

compounds, acid extractable organic compounds, and pesticides listed on the August 1980 EPA list of priority pollutants. Analyses were performed by Key Laboratory and Continental Technical Laboratory Services in Dallas, Texas. Laboratory results are included in Appendix I.

b. Laboratory Soil Classification. Atterberg Limits, sieve analysis, and natural water content tests were performed on selected soil samples by the Corps of Engineers Southwestern Division (SWD) Laboratory. The resulting classifications, based on the Unified Soil Classification System, are used to identify material types shown in the geologic sections presented on drawing 1. Tabulated results are presented as part of Appendix I. Laboratory visual classifications were used to verify field classifications.

c. Laboratory Permeability Test. Two falling head permeability tests were performed in the laboratory on specimens cut from undisturbed (denison) samples of the Jackson clay-shale. The tests were performed at the Corps of Engineers SWD Laboratory. The Jackson clay-shale are being investigated for effectiveness as a lower boundary in an encapsulation closure scheme.

3-04. Analysis.

a. Contamination Background Levels and Cleanup Limits - A consent agreement between the ADPCE and PBA is the basis for this remedial action. This agreement is based on Arkansas law which prohibits pollution of Arkansas waters but does not identify contaminants or allowable limits. Through discussions and letters, the ADPCE identified parameters and concentrations of concern as follows:

(1) Heavy Metals.

(a) Total ion concentrations. The maximum contaminant level (MCL) for the 8 heavy metals listed in RCRA (40 CFR 261.24) were set at 10 times the background levels. "Arsenal-wide" background levels were calculated as the mean of 102 samples collected at uncontaminated areas near 17 of the sites.

(b) EP toxicity concentrations. In addition to meeting the MCL for the total ion method, the ADPCE also required that the samples not exceed one-tenth the regulatory values shown in RCRA (40 CFR 261.24) when analyzed using EP methodology. Table 3-1 lists background levels and MCL's (cleanup limits) for these heavy metals.

TABLE 3-1
HEAVY METAL BACKGROUND LEVELS AND CLEANUP LIMITS

Contaminant	Background mean (mg/kg)	Site Cleanup Limits	
		Total Ion MCL (mg/kg)	EP Toxicity MCL (mg/l)
Arsenic (As)	1.30	13.0	0.50
Barium (Ba)	28.70	290.0	10.00
Cadmium (Cd)	< 0.50 <u>1/</u>	5.0	0.10
Chromium (Cr)	< 5.00	50.0	0.50
Lead (Pb)	7.55	75.5	0.50
Mercury (Hg)	< 0.10	1.0	0.02
Selenium (Se)	0.18	1.8	0.10
Silver (Ag)	< 0.50	5.0	0.50
Zinc (Zn)	8.50	<u>1/</u>	<u>1/</u>

1/ < = less than.

2/ Background level for Zinc was determined since it is a common constituent of demilitarized ordnance wastes. Zinc is not an RCRA-listed contaminant, therefore, cleanup limits were not required by ADPCE.

(2) Organics - A GC-mass-spectrometer scan was conducted on samples from those sites where there is evidence of disposal of organic compounds. At those sites where the tests revealed the presence of compounds listed in RCRA (40 CFR 261.33), an individual determination of the hazard of the substance was made. This was dependent on the compounds and the amount present in the sample. This determination was used to develop the recommended closure plan and is subject to approval of the ADPCE. No testing for the organic compounds found at the site was performed on the soil samples from the background hole. The organics of primary concern are not naturally occurring and should not be present in any concentration in the soil.

b. Determining Extent of Metal Contamination. To determine the procedure for laboratory testing, one water and two sediment samples were tested for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and zinc. Sediment sample SD-1, taken from the north side of the pond, contained the highest concentrations of the RCRA listed heavy metals. Because most of the RCRA listed heavy metals were found in the sediments, the holes surrounding the pond were also tested for those heavy metals and zinc. Lead, barium, cadmium, and chromium were found to be the primary contaminants in the sediment and water samples and were chosen for testing in the holes drilled below the pond surface. The depth to which soil would be contained or removed in the cleanup of Site 34 was determined by comparing the measured values of each contaminant with the cleanup values presented in table 3-1. This data is presented graphically for each boring in Appendix II. With the results plotted in this manner the extent of heavy metal contamination and the depth of soil to be contained or removed is easily determined.

c. Metal Contamination Results.

(1) EP Toxicity Test. Six EP toxicity tests were performed on sediment and/or soil samples located immediately above or directly below the vertical limits of the contamination line as shown on dwg 1. All results were less than the ADPCE cleanup limit for EP toxicity (see table 3-2).

TABLE 3-2
RESULTS OF EP TOXICITY ANALYSIS
(mg/l)

Hole # (mg/l)	Depth	Location	REPORTED CONCENTRATION IN SAMPLE							EXTRAC
			1/ Ag	As	Ba	Cd	Cr	Hg	Pb	Se
SD-1	0.2-0.5	Sediment	<.01	2/ <.001	<.50	.003	<.01	.0002	.03	.0012
7	5.5-5.8	Sediment	<.01	.016	<.50	.005	<.01	.0012	.06	<.0004
8	4.4-5.3	Soil	<.01	.001	<.50	.005	<.01	.0008	<.01	<.0004
9	4.0-4.3	Soil	<.01	<.001	<.50	.005	<.01	<.0001	.07	<.0004
10	4.5-5.0	Soil	<.01	<.001	<.50	.003	<.01	<.0001	.04	<.0004
11	4.4-4.8	Sediment	<.01	.005	<.50	.010	<.01	<.0001	.05	<.0004
RCRA limit			5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

1/ See boring log in "Appendix II - Boring Contaminant Plots" for sample location.

2/ < = less than.

(2) Sediment and Underlying Soil - Total ion test results from the sediment samples indicate the presence of all the RCRA listed metals with the exception of selenium. Concentrations were found to be higher on the North side of the pond. The highest concentrations of metals in the sediments are as follows: 1.7 mg/kg Ag, 3.2 mg/kg As, 570 mg/kg Ba, 14 mg/kg Cd, 1600 mg/kg Cr, 1.5 mg/kg Hg, 65 mg/kg Pb, and 220 mg/kg Zn. The sediments range in thickness from 0.2 to 0.5 feet. Soil underlying the sediment did not contain any of the metals in concentrations above cleanup limits.

(3) Soil Surrounding the Pond. Test results from all of the borings in the soil surrounding the pond indicated only background levels of metals. Given these test results, only the sediments in the pond are contaminated with metals. Approximately 500 cubic yards of sediments contaminated with heavy metals exist at Site 34. See section 4 for expanded closure quantities.

d. Determining Extent of Organic Contamination. One sediment and one water sample from Site 34 were analyzed for purgeable organics, base/neutral extractable organics, acid extractable organics, and pesticides listed on the August 1984 EPA list of priority pollutants. Seventeen compounds were detected in the sediment and water samples tested and are presented in table

3-3. Of these 17 compounds, four were chosen (methylene chloride, tetrachloroethylene, toluene, and dibenzo (a,h) anthracene) for further analysis in the soil because of their presence in the pond sediments. Those compounds with a specific gravity greater than one would be expected to sink in water to an impermeable layer and those with a specific gravity less than one would be expected to rise to the surface of the pond or the phreatic surface. Holes 34-12 and 34-13 were tested at three locations as shown in figure 3-1: (1) top of the perched water table, (2) top of the aquitard supporting the perched water table, and (3) permanent water table. Holes 34-1 to 34-4 and 34-7 through 34-11 were tested throughout their relatively shallow depths.

e. Results of Organic Contamination. Results of the organic testing on the soil are presented in table 3-4. The only organic result of some concern is the value of 13 ppm for dibenzo (a,h) anthracene in hole 34-13 at a depth of 33-36 feet. Samples taken above and below this level have less than 2 mg/kg indicating its presence is quite limited. The sample containing debenzo (a,h) anthracene was a saturated sand and the hole is not strictly downgradient of the site. Hole 34-12 is downgradient of the site and the soil sample from this depth had no detectable dibenzo (a,h) anthracene in it. It is concluded that organic contamination from Site 34 is very minor and limited to the pond sediments which have an estimated volume of 500 cubic yards. See section 4 for expanded closure plan quantities.

f. Pond Water. Samples of water from the pond were analyzed for metals and organics. Lead was the only metal present in a significant concentration (0.05 mg/l), although concentrations of arsenic, cadmium, chromium, mercury, and selenium just above laboratory detection limits were measured as well. Concentrations of carbon tetrachloride, methylene chloride, tetrachloroethylene, toluene, trichloroethane, and diethyl phthalate were present in the water in concentrations less than 0.02 mg/l, and phenol was present in a concentration of 0.13 mg/l. The pond contains approximately 1,800,000 gallons of water.

TABLE 3-3

RESULTS OF WATER/SEDIMENT ORGANIC ANALYSES OF
SITE 34

Compound	Sample	Minimum Level Detectable	Concentration in Sample	Specific Gravity
<u>Volatile Compounds</u>				
Carbon tetrachloride	Water	0.001 mg/l	0.003 mg/l	1.585
Methylene chloride	Water	0.001 mg/l	0.017 mg/l	1.325
Methylene chloride	Sediment	0.004 mg/kg	0.348 mg/kg	
Tetrachloroethylene	Water	0.001 mg/l	0.020 mg/l	1.6
Tetrachloroethylene	Sediment	0.006 mg/kg	0.542 mg/kg	
Toluene	Water	0.001 mg/l	0.002 mg/l	0.87
Toluene	Sediment	0.002 mg/kg	0.367 mg/kg	
1,1,1-trichloroethane	Water	0.001 mg/l	0.019 mg/l	1.3249
1,1,1-trichloroethane	Sediment	0.003 mg/kg	0.045 mg/kg	
Benzene	Sediment	0.002 mg/kg	0.019 mg/kg	0.87
Chloroform	Sediment	0.005 mg/kg	0.014 mg/kg	1.498
trichloroethylene	Sediment	0.006 mg/kg	0.011 mg/kg	1.4556
<u>Acid extractable compounds</u>				
Phenol	Water	0.02 mg/l	0.13 mg/l	1.072
<u>Base/neutral extractable compounds</u>				
Diethyl phthalate	Water	0.007 mg/l	0.021 mg/l	1.123
Benzo (a) pyrene	Sediment	0.4 mg/kg	2.81 mg/kg	
Benzo (g,h,i) perylene	Sediment	0.6 mg/kg	3.51 mg/kg	
Benzo (k) Fluoranthene	Sediment	0.5 mg/kg	4.96 mg/kg	
Chrysene	Sediment	0.3 mg/kg	3.18 mg/kg	1.274
Dibenzo (a,h) anthracene	Sediment	1.0 mg/kg	10.7 mg/kg	1.35
Di-n-butyl phthalate	Sediment	0.09 mg/kg	7.72 mg/kg	1.04
naphthalene	Sediment	0.2 mg/kg	16.3 mg/kg	1.145

TYPICAL SUBSURFACE PROFILE

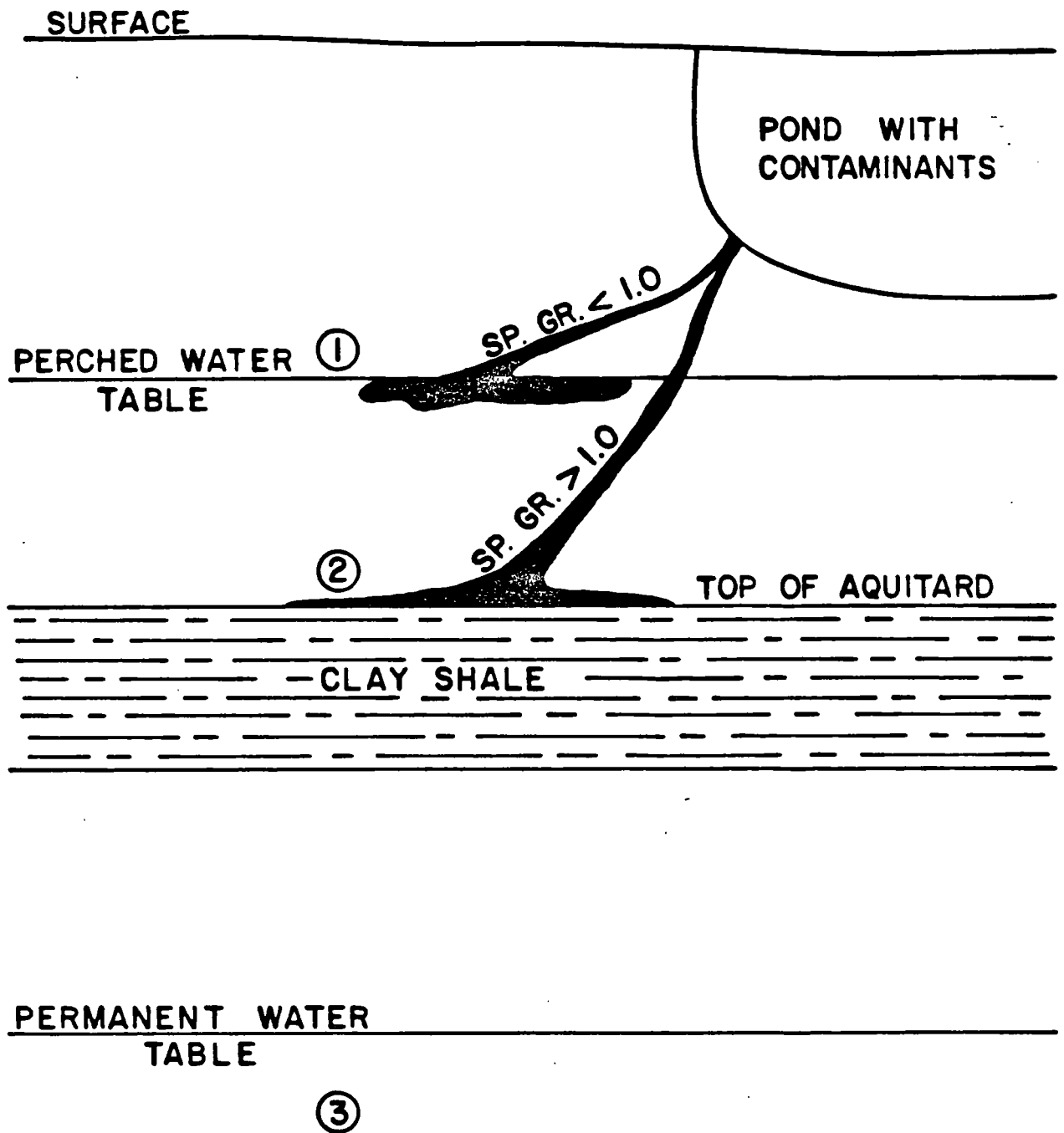


FIGURE 3-1

TABLE 3-4
RESULTS OF SOIL ORGANIC ANALYSES
SITE 34
(Results in mg/kg)

Hole	Jar	Depth (ft)	Methylene Chloride	Tetrachloro- ethylene	Toluene	Dibenzo (a,h) anthracene
1	1	0.0-1.0	0.09	0.010	0.09	0.04
1	3	2.0-3.0	< 0.005	0.004	0.23	3.8
1	5	4.5-7.5	0.02	0.004	0.21	2.7
1	7	9.5-12.5	0.04	0.004	0.09	2.0
2	1	0.0-1.0	0.05	0.004	0.22	2.4
2	3	2.0-3.0	0.02	0.004	0.38	3.3
2	6	7.0-10.0	0.02	0.004	0.23	4.0
3	1	0.0-1.0	0.02	0.004	0.24	1.0
3	3	2.0-3.0	0.03	0.002	0.22	0.83
3	5	6.0-10.0	0.17	0.005	0.42	1.2
4	1	0.0-1.0	0.02	0.004	0.32	0.83
4	3	2.0-3.0	< 0.005	0.008	0.44	1.4
4	6	7.0-10.0	0.02	0.004	0.37	0.85
7	1	5.5-5.8	< 0.005	0.006	0.29	0.52
7	2	5.8-5.9	0.25	0.005	0.48	1.8
8	1	4.2-4.4	< 0.005	0.005	0.29	0.89
8	2	4.4-5.3	0.17	0.004	0.39	0.57
9	1	3.8-4.0	0.88	0.004	0.26	1.0
9	2	4.0-4.3	1.6	0.005	0.35	0.44
10	1	4.3-4.5	0.10	0.002	0.22	1.5
10	2	4.5-5.0	0.10	0.003	< 0.04	0.23
11	1	4.4-4.8	0.06	0.004	0.23	0.82
11	2	4.8-5.7	< 0.05	0.003	0.19	1.1
12	4	9.0-11.0	< 0.5	< 0.1	< 0.5	< 0.03
12	5	11.0-14.0	< 0.5	1.0	< 0.5	< 0.03
12	14	35.0-38.5	< 0.5	1.3	< 0.5	< 0.03
13	3	6.0-9.0	< 0.5	1.2	< 0.5	< 0.03
13	4	9.0-13.0	< 0.5	1.3	< 0.5	< 0.03
13	12	32.0-33	-	-	-	1.7
13	13	33.0-36.0	< 0.5	1.1	< 0.5	13.0
13	14	36.0-39.0	-	-	-	1.9

g. Groundwater Contamination. Groundwater encountered at site 34 belongs to the Jackson/Quaternary aquifer. This aquifer generally yields small amounts of low quality water and is not used for any water supply purpose in the vicinity of the arsenal. Drinking water in the area is supplied from the Sparta Sand which is about 600 feet below the site and is separated from it by low permeability Jackson and upper Claiborne groups. No monitoring wells are in the vicinity of Site 34.

(1) Perched. No soil or groundwater contamination was detected in the zone of the perched water table.

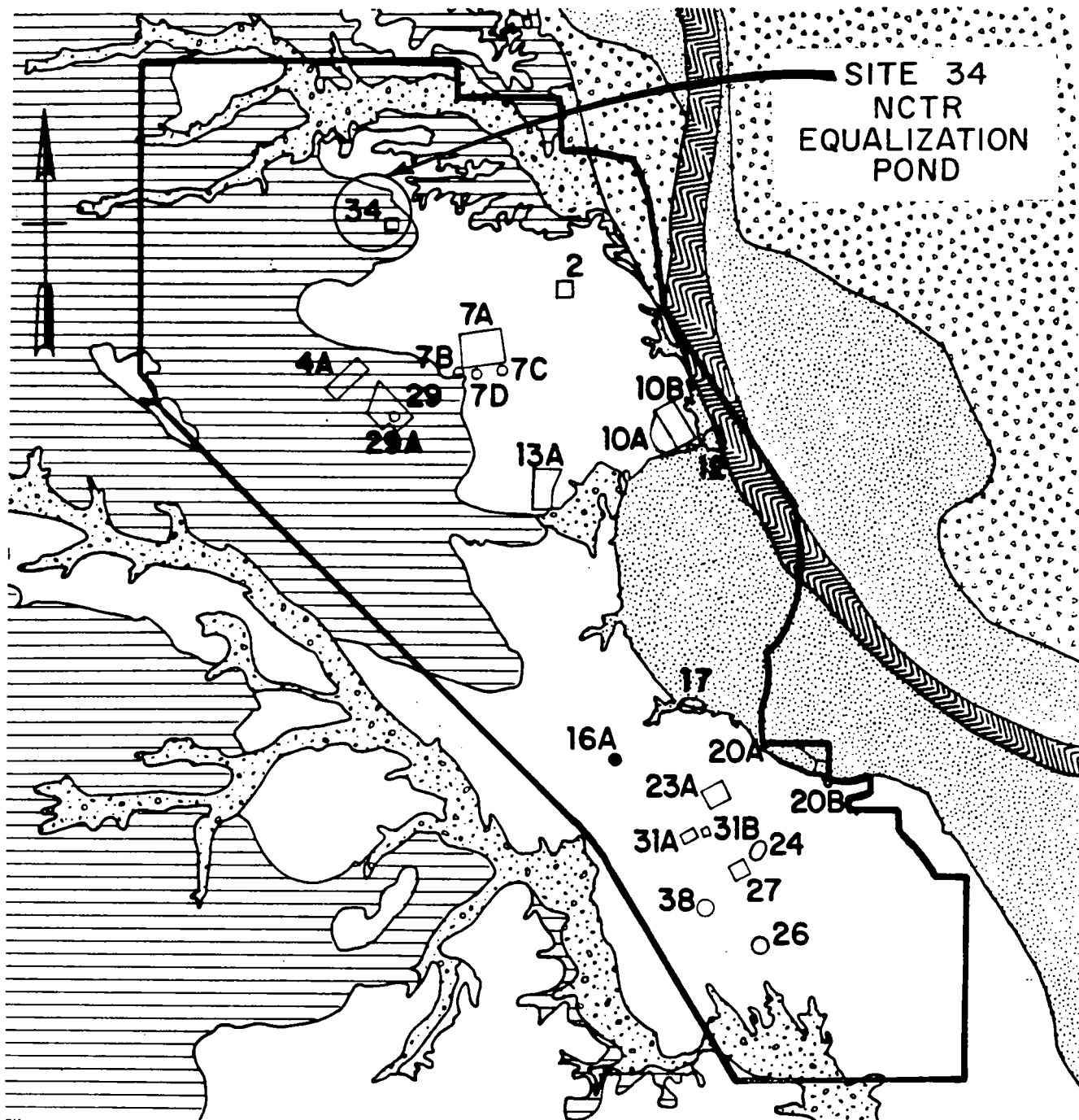
(2) Permanent. Although one soil sample from the zone of the permanent water table had somewhat elevated concentrations of one organic compound, the 0.2 to 0.5 foot thickness of sediment contamination and the much deeper water table make it unlikely that Site 34 is contributing to groundwater contamination in the area.

3-05. Stratigraphic Results.

a. General The pond at Site 34 has 3 to 5 feet of water on top of 0.2 to 0.5 feet of soft pond sediments which overlie a stiff clay. The site is situated on terrace deposits approximately 12 feet thick. The terrace deposits consist of interbedded silt and sand with several thin beds of silty clay. Clay-shale of the Jackson Group underlies the terrace deposits and is approximately 20 feet thick. A clayey sand is present beneath the clay-shale. This site is shown in figure 3-2 on a map of geologic environments at PBA.

b. Jackson Group. A geologic section is presented in drawing 1. The uppermost bed of the Jackson on the site is a clay-shale. Depths to this stratum range from 12 to 14 feet. The results of an in-situ permeability test taken at a depth of 14.1 feet was 4×10^{-8} cm/sec. Falling head permeability tests were also performed at the SWD Laboratory on one sample of a deeper stratum. At 37 feet in depth, the permeability was found to be 5.5×10^{-6} cm/sec. The 20-foot thickness and relative impermeability of the clay-shale make it an excellent stratum for use in an in-situ encapsulation scheme.

c. Water Table. The permanent water table is approximately 23 feet below natural ground at elevation 245. The gradient is to the east at approximately 5 feet per thousand feet. A perched water table was found to be present near the surface during drilling operations.



ARKANSAS RIVER
ARKANSAS RIVER
DEPOSITS



TERRACE



BACKSWAMP



ALLUVIUM



RECENT ALLUVIUM

JACKSON GROUP

GEOLOGIC ENVIRONMENTS

SCALE IN FEET
 2000 0 2000 4000

IV - CLOSURE PLAN

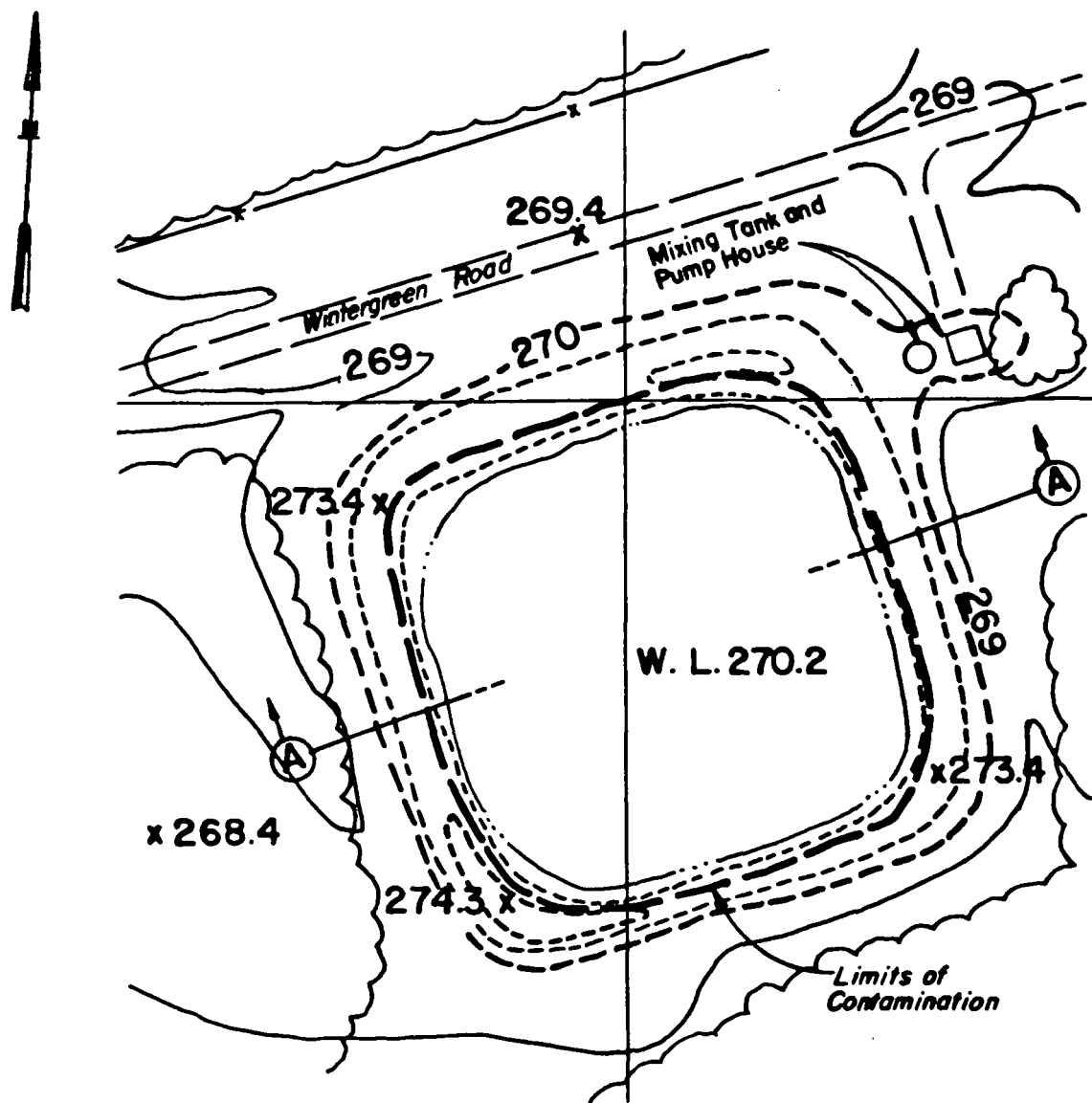
4-01. General. The proposed closure plan is to excavate and haul the contaminated pond sediments to the hazardous waste landfill and regrade the site (see figures 4-1 and 4-2) since this plan is more cost effective than on-site closure. During the project's concept design phase, which was completed in August 1984, in-situ encapsulation of the site's contaminated material was recommended since detailed organic analysis of the pond sediments and underlying soils had not yet been completed. The results of these analyses have indicated that organic contamination at the site is limited and suitable for landfill disposal, however, the presence of these RCRA-listed organics classifies the contaminated sediments as a RCRA hazardous waste upon their excavation. Consequently, they must be disposed in a RCRA-approved landfill facility. The proposed closure plan would be accomplished as described below.

4-02. Pond dewatering. The pond would be dewatered first. Water quality tests on pond water samples indicate concentrations of heavy metals to be below water quality standards. Furthermore, organic residuals in the pond water are extremely dilute. Therefore, the water would be pumped over the dikes to follow natural overland drainage away from the site. All vegetation would be removed and disposed by open burning. The existing inflow and outflow pipes would be plugged, and the pump house and mixing tank demolished.

4-03. Contaminated material movement. Once the pond has been dewatered, the pond sediments would be stripped and hauled to the hazardous waste landfill. Although the in-situ volume of these sediments is only about 500 cubic yards, it is not considered practical to remove only the thin layer of sediments. This closure plan is based on removal of a 12-inch layer of sediments and underlying soil recognizing typical construction methods and to insure removal of all contaminated material. Excavation quantities total 2200 cubic yards, including allowances of 15 and 20 percent for overexcavation and bulking, respectively. To prevent potential spread of contamination along the haul route, a temporary washrack facility would be constructed at the site to allow washdown of hauling vehicles prior to their leaving the site area. Construction equipment would also be washed prior to handling clean fill/earth, and prior to transportation off-site. Washwater would be collected in a holding tank and transported to the Arsenal's industrial waste treatment facility for treatment and disposal.

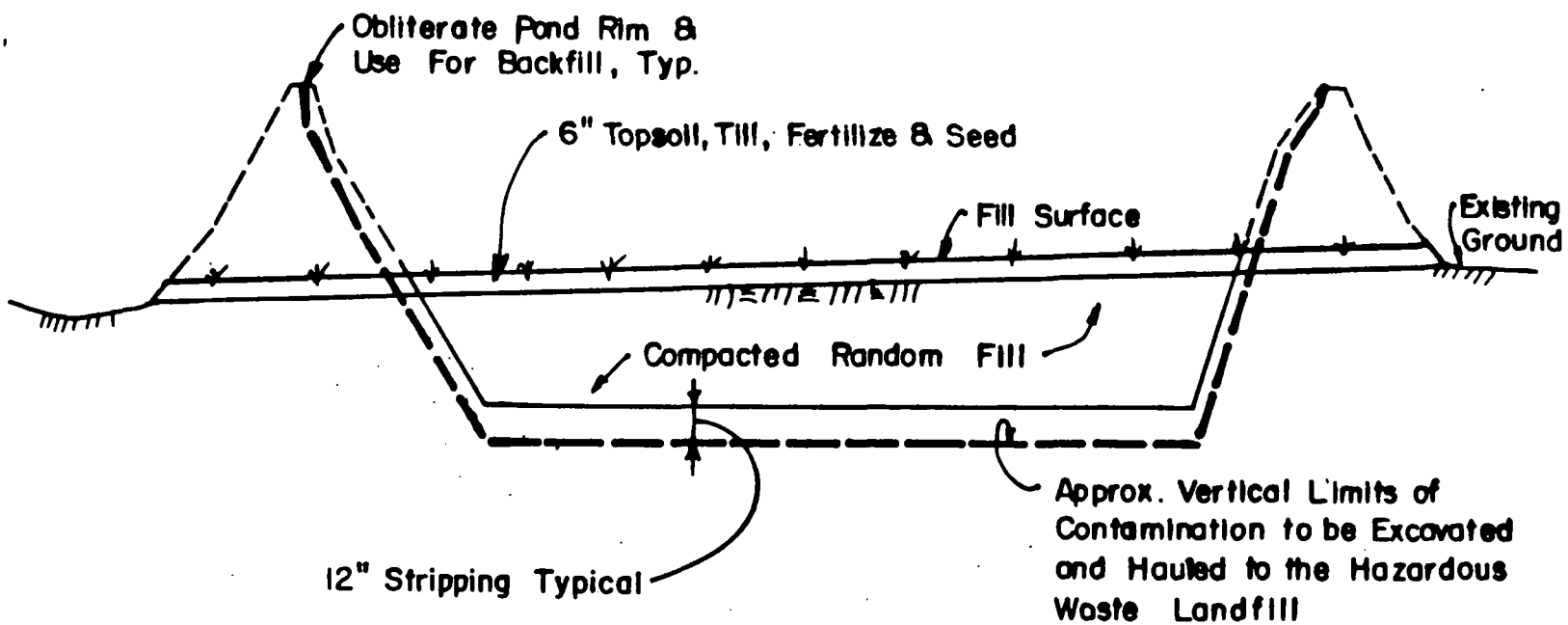
4-04. Regrading. Once the contaminated material is removed and the pipes plugged, the pond dikes would be dozed into the excavated pond area along with additional compacted random fill to bring the area to existing natural contours allowing positive drainage off the site. All areas disturbed during closure would be covered with 6 inches of topsoil, tilled, fertilized, and seeded.

4-05. Operation and maintenance. Site 34 will remain closed. Some maintenance would be required for approximately 2 years to protect against erosion until vegetative growth is firmly established. Then the site would be mowed in accordance with the PBA's existing mowing schedule. No groundwater monitoring or other post closure care would be required as the source for potential groundwater contamination would be removed.



**SITE 34
CLOSURE PLAN**

Scale 1" = 80'



SITE 34
CLOSURE SECTION A-A

NO SCALE

V - ALTERNATIVE CLOSURE PLAN

5-01. General. The clay-shale layer discussed in Section 3 forms the basis for the alternative closure plan of in-situ encapsulation. It would be utilized as the lower boundary of a closure cell. A slurry wall keyed into the clay-shale layer and covered with a clay cap would be constructed around and over the dewatered pond. This alternative on-site closure plan was developed to confirm the economic feasibility of the proposed closure plan. The plan is shown in figure 5-1.

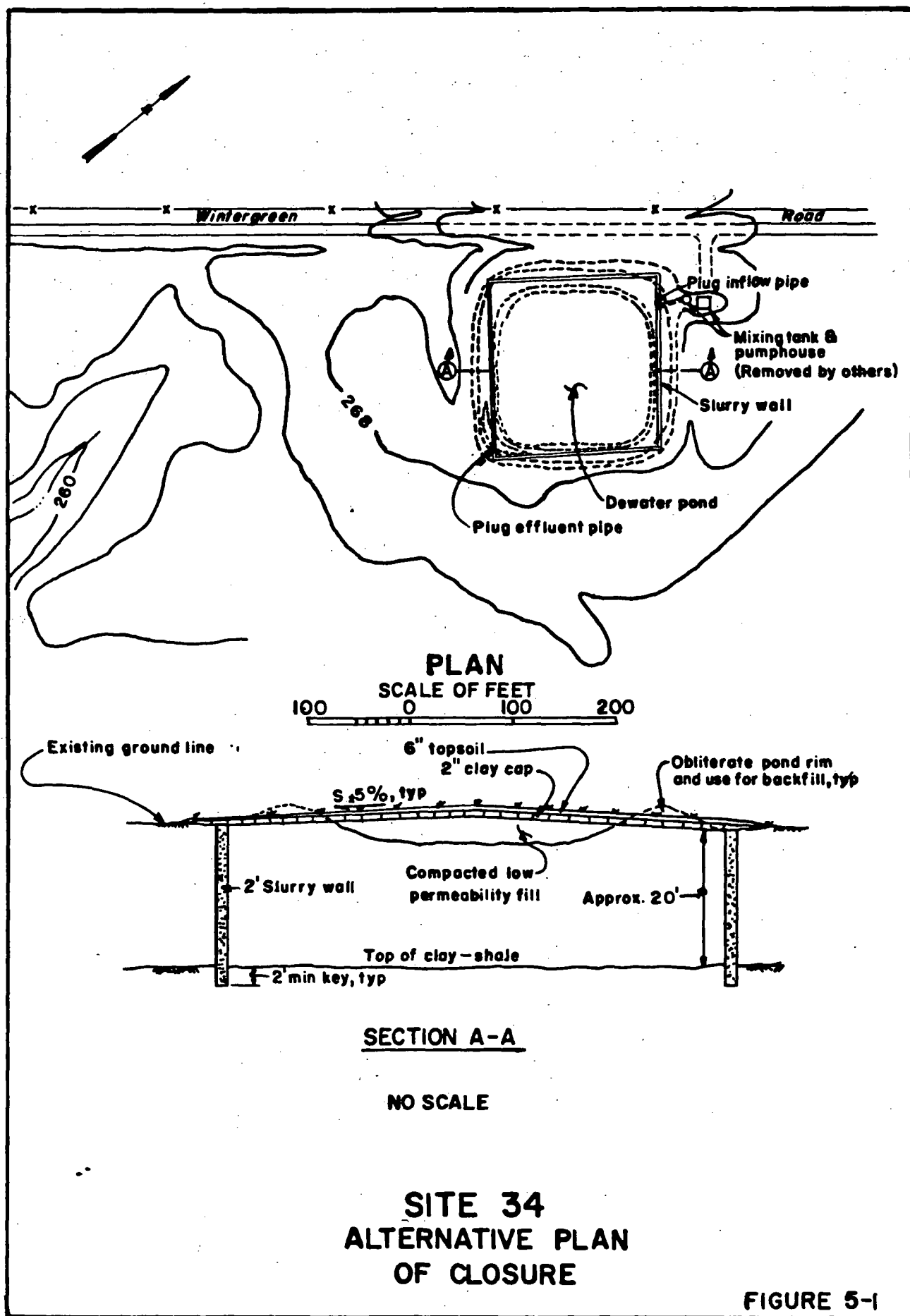
5-02. Construction. Construction of this closure cell would be accomplished as follows:

a. Pond dewatering. The pond would be dewatered as described in paragraph 4-02.

b. Closure cell. Once the pond has been dewatered and the vegetation cleared and grubbed, the pond dikes would be dozed into the pond along with additional compacted random fill to bring the pond area to existing natural contours allowing positive drainage off the site. The slurry wall would then be constructed around the site, keyed a minimum of 2 feet into the clay-shale which is about 20 feet beneath the site.

c. Cover and grading. Once all backfill has been placed within the cell, it would be graded to provide a positive drainage away from the site. The cell would then be capped with a 2-foot thick clay cover keyed into and extending beyond the slurry wall to prevent vertical migration of contaminants and to provide runoff control. The entire disturbed area of the site and the closure cell would be covered with 6 inches of topsoil and revegetated.

d. Operation and Maintenance. Requirements would be similar to those discussed for the proposed closure plan except that ground water monitoring would be required throughout the post-closure period. Fencing would also be required to ensure against unauthorized site entry or excavations.



VI - COSTS

6-01. General. Unit prices are based on average bid prices for similar type projects constructed or under construction in the Tulsa District and adjusted to January 1987 price levels.

a. Contaminated material movement. Costs for transporting all contaminated materials include costs of excavation, hauling, placement, and compaction of materials into the hazardous waste landfill.

b. Borrow availability. It was assumed that all required fill and topsoil would be supplied from approved borrow sources located on arsenal property and a 10-mile haul distance was assumed to the site for unit cost purposes. Detailed borrow area investigations would be conducted during the final design to confirm the availability of required fill and top soil in sufficient quantities within a 10-mile haul distance.

c. Dewatering. Pond dewatering costs assume direct pumping of water over the pond dikes into natural drainage paths.

6-02 Estimated Costs. A comparison of estimated costs for the proposed and alternative closure plans are shown in table 6-1 which indicates a \$71,400 savings for the alternative on-site closure plan. However, operation and maintenance costs for the alternative plan are significantly higher (\$8,000/year) due to the requirement for maintenance and semi-annual testing of the four groundwater monitoring wells. Based on a 30-year post-closure monitoring period utilizing a discount rate of 10 percent, the life cycle cost resulting from groundwater well maintenance, sampling, and testing totals \$75,200. This cost does not include operations and maintenance cost escalation which would occur during the 30-year monitoring period. Thus a comparison of life cycle costs (table 6-2) indicates that the proposed closure plan is more cost effective by \$3,800.

TABLE 6-1
ESTIMATED CAPITAL COSTS
(January 1987 Price Levels)

ITEM	PROPOSED CLOSURE PLAN (Off-Site) \$	ALTERNATIVE CLOSURE PLAN (On-Site) \$
Site Preparation	3,608	3,608
Closure Earthwork	35,357	19,484
Contaminated Material Movement (2200 cy)	22,000	-
Slurry Trench	-	87,300
Fencing/Monitoring Wells		35,084
Site Grading and Revegetation	<u>5,035</u>	<u>5,035</u>
Subtotal	66,000	150,511
Contingencies @ 5% <u>+</u>	3,300	7,489
Subtotal	69,300	158,000
Supervision and Inspection @ 5.5% <u>+</u>	<u>3,800</u>	<u>8,700</u>
TOTAL	73,100 <u>1/</u>	166,700

1/ Landfill Capacity Cost = \$165,000, therefore, total cost of proposed closure plan = \$238,100.

TABLE 6-2

LIFE CYCLE COSTS

<u>Item</u>	<u>Proposed Closure Plan (Landfill)</u>	<u>Alternative Closure Plan (On-Site)</u>
Capital Cost (incl Prorata LF Cost)	\$238,100	\$166,700
Groundwater Monitoring	-	<u>75,200</u> <u>1/</u>
Total Life Cycle Cost	\$238,100	\$241,900

1/ Life Cycle (present worth) factor = 9.40 for annual cost of \$8,000 @ 10% discount rate for 30-year life (post closure period).

EXHIBIT

EXHIBIT A

SITE PHOTOGRAPH



View looking South across Wintergreen Road at pool. Note mixing tank and pumphouse in left center of photograph.

APPENDICES

APPENDIX I

LABORATORY, CHEMISTRY AND SOIL REPORTS

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758 (2 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 26 Mar 84
Received:

From:
Geotechnical Branch
Tulsa District

MATERIAL: Water
No. and type of samples: 1 jar sample
Source or other identification: Hole 34-WS-1

Date received: 28 March 1984

REMARKS:

Results of Chemical Analysis of Water

Table 1

Results of tests telephoned on 26 Apr 84.

Report sent to:

Tulsa District

Copy furnished:

Date:

5 May 1984

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



Results of Chemical Analysis of Water⁽¹⁾

<u>SWD</u> <u>Lab No</u>	<u>Site</u> <u>Hole</u>	<u>Field</u> <u>No.</u>	<u>Depth</u>	<u>Ag</u>	<u>As</u>	<u>Ba</u>	<u>Cd</u>	<u>Cr</u>	<u>Hg</u>	<u>Pb</u>	<u>Se</u>	<u>Zn</u>	<u>pH</u>
5792	34	WS1	Pond	<0.01	<0.001	<0.5	0.005	<0.01	<0.0001	0.05	<0.0004	0.09	

Minimum reported concentration	0.01	0.001	0.5	0.002	0.01	0.0001	0.01	0.0004	0.01
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(1) Results reported in mg/l.

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-1 (2 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 16 Apr and 2 May 84
Received:

From:
Geotechnical Branch
Tulsa District

MATERIAL: Soil
No. and type of samples: 8 jar samples
Source or other identification: Holes 34-SD-1 and 34-SD-2,
34-1 thru 34-4

Date received: 17 Apr and 2 May 84

REMARKS:

Results of Chemical Analysis of Soil

Table 1

Results of tests telephoned to TDO on 27 Apr and 3, 4 May 84.

Report sent to:
Tulsa District


Copy furnished:

Date:

15 May 84

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



Results of Chemical Analysis of Soils (1)

SWD Lab No	Site Hole	Field No.	Depth	Ag	As	Pb	Cd	Cr	Hg	Pb	Se	Zn
6559	35-SD-1	North		1.7	3.2	320	1.9	74	1.5	65	<0.1	220
6560	35-SD-2	South		<0.5	<1.0	54	0.8	<5.0	<0.1	9.5	<0.1	26
6229	34-1	J-1	0-0-1.0	<0.5	<1.0	36	<0.5	6.7	<0.1	17	<0.1	9.9
6230		J-2	1.0-2.0	<0.5	<1.0	23	<0.5	<5.0	<0.1	9.8	<0.1	6.3
6231		J-3	2.0-3.0	<0.5	<1.0	28	<0.5	<5.0	<0.1	13	<0.1	7.1
6248	34-2	J-2	1.0-2.0	<0.5	<1.0	31	<0.5	<5.0	<0.1	10	<0.1	7.2
6254	34-3	J-2	1.0-2.0	<0.5	1.6	<20	<0.5	<5.0	<0.1	11	<0.1	4.6
6258A	34-4	J-2	1.0-2.0	<0.5	<1.0	<20	<0.5	5.1	<0.1	10	<0.1	6.4
Minimum Reported Concentration				0.5	1.0	20.0	0.5	5.0	0.1	1.0	0.1	1.0

(1) Results reported in mg/kg

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-2 (2 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 16 Apr 84
Received:

From: Chief
Geotechnical Branch
Tulsa District

MATERIAL: Disturbed soil samples
No. and type of samples: 10 jar samples
Source or other identification: Borings: 1 through 4

Date received: 17 Apr 84

REMARKS:

Results of Tests

Table 1

Advance data sent 8 May 84.

Report sent to:

Tulsa District

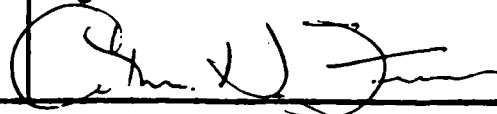
Copy furnished:

Date:

19 May 1984

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



Results of Tests of Disturbed Soil Samples

Boring No.	Field No.	SWD No.	Depth ft.	Mechanical Analysis			Atterberg Limits				Water Content %	Description
				Gr	Sa	Fi	LL	PL	PI	LS		
34-1	J-1	G-6229	0.0- 1.0	0	11	89	27	21	6		23.2	CL-ML CLAY, gray, moist, few small roots.
	J-3	G-6231	2.0- 3.0	0	12	88	35	17	18		25.5	CL CLAY, gray, moist.
	J-5	G-6233	4.5- 7.5	0	8	92	43	23	20		36.3	CL CLAY, light gray, moist.
	J-7	G-6235	9.5-12.5									CL CLAY, light gray and yellow, moist.
	J-10	G-6238	16.5-18.0									CL CLAY, gray, moist.
	J-12	G-6240	22.0-24.0	0	24	76	63	23	40		34.8	CH CLAY, sandy, dark gray, moist.
	J-13	G-6241	24.0-27.0	0	25	75	46	24	22		36.9	CL CLAY, sandy, dark gray, moist.
34-2	J-2	G-6248	1.0- 2.0	0	15	85	27	20	7		21.5	CL-ML CLAY, gray, moist.
34-3	J-2	G-6254	1.0- 2.0	0	15	85	22	20	2		26.2	ML SILT, gray, wet, free water.
34-4	J-2	G-6258A	1.0- 2.0	0	10	90	32	19	13		23.4	CL CLAY, gray, moist.

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-3 (3 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 1 June 84
Received:

From: Chief
Geotechnical Branch
Tulsa District

MATERIAL: Soil
No. and type of samples: 8 jar samples
Source or other identification: Holes: 1 thru 4 and SD-1

Date received: 17 April, 2 May 84

REMARKS:

Results of Chemical Analysis of Soil Samples Table 1
Results of Chemical Analysis of Soil for E. P. Toxicity Table 2

Results telephoned to TDO on 16 and 26 June 84.

Report sent to:

Copy furnished:

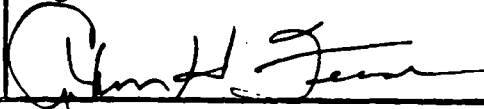
Tulsa District

Date:

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature

17 Aug 84



Results of Chemical Analysis of Soil⁽¹⁾

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se	Zn
34-1	J-4	6232	3.0- 4.5			73		< 5.0		8.6		3.8
	J-5	6233	4.5- 7.5			23		< 5.0		17		16
	J-6	6234	7.5- 9.5			< 20		< 5.0		7.6		9.2
	J-7	6235	9.5-12.5			< 20		< 5.0		9.3		18
34-2	J-1	6247	0.0- 1.0			35		< 5.0		11		5.4
34-3	J-1	6253	0.0- 1.0			22		< 5.0		10		3.9
34-4	J-1	6258	0.0- 1.0			< 20		< 5.0		8.6		6.4

Minimum reported concentration 0.5 1.0 20.0 0.5 5.0 0.1 1.0 0.1 1.0

(1) Results reported in mg/kg

Results of Chemical Analysis of Soil for EP Toxicity⁽¹⁾

<u>Hole</u>	<u>Field No.</u>	<u>SWD No.</u>	<u>Depth</u>	<u>Ag</u>	<u>As</u>	<u>Ba</u>	<u>Cd</u>	<u>Cr</u>	<u>Hg</u>	<u>Pb</u>	<u>Se</u>
34	SD-1	6559	North	< 0.01	< 0.001	< 0.50	0.003	< 0.01	0.0002	0.03	0.0012

Minimum Reported Concentration	0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004
EP Toxicity Limits	5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

(1) Results reported in mg/l.

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-4 (9 pages)

PROJECT: Pine Bluff Arsenal
Feature: Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 20 June 84
Received:

From: Chief
Geotech Branch
Tulsa District

MATERIAL: Water and Sediment
No. and type of samples: 1 water and 1 sediment
Source or other identification: Water sample 34-Ws-2; Sediment
Sample 34-SD-3

Date received: 21 May, 21 June 84

REMARKS:

Results of tests for Priority Pollutants conducted
by Continental Technical Serviced, Dallas, TX.

Results of tests telephoned to TDO on 31 July 84.

Report sent to:
Tulsa District

Copy furnished:

Date:

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



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CONTINENTAL TECHNICAL SERVICES
9742 SKILLMAN • DALLAS, TEXAS 75243 • 214/343-2025

CTEK REPORT 84-0814

U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 61
TULSA, OK 74121

NDPES PART 2C
PRIORITY POLLUTANTS

P.O. NUMBER: DACW63-84-M-1171

EHL SAMPLE #E2927

MATRIX - WATER

FIELD #6915
SITE 34 POND (WS-1)

VOLATILE COMPOUNDS

RESULTS

DETECTION LIMITS

1V. ACROLEIN	ND	0.01 mg/l
2V. ACRYLONITRILE	ND	0.01 mg/l
3V. BENZENE	BQL	0.001 mg/l
4V. BIS (CHLOROMETHYL) ETHER	ND	0.001 mg/l
5V. BROMOFORM	ND	0.005 mg/l
6V. CARBON TETRACHLORIDE	.003	0.001 mg/l
7V. CHLOROBENZE	ND	0.006 mg/l
8V. CHLORODIBROMOMETHANE	ND	0.005 mg/l
9V. CHLOROETHANE	BQL	0.001 mg/l
10V. 2-CHLOROETHYL VINYL ETHER	ND	0.001 mg/l
11V. CHLOROFORM	ND	0.002 mg/l
12V. DICHLOROBROMOMETHANE	ND	0.002 mg/l
13V. DICHLORODIFLUOROMETHANE	ND	0.01 mg/l
14V. 1,1-DICHLOROETHANE	ND	0.005 mg/l
15V. 1,2-DICHLOROETHANE	ND	0.005 mg/l
16V. 1,1-DICHLOROETHYLENE	BQL	0.006 mg/l
17V. 1,2-DICHLOROPROPANE	ND	0.005 mg/l
18V. 1,2-DICHLOROPROPYLENE	ND	0.005 mg/l
19V. ETHYLBENZENE	ND	0.007 mg/l
20V. METHYL BROMIDE	ND	0.01 mg/l
21V. METHYL CHLORIDE	ND	0.01 mg/l
22V. METHYLENE CHLORIDE	0.017	0.001 mg/l
23V. 1,1,2,2-TETRACHLOROETHANE	ND	0.006 mg/l
24V. TETRACHLOROETHYLENE	0.020	0.001 mg/l
25V. TOLUENE	0.002	0.001 mg/l
26V. 1,2-TRANS-DICHLOROETHYLENE	ND	0.005 mg/l
27V. 1,1,1-TRICHLOROETHANE	0.019	0.001 mg/l
28V. 1,1,2-TRICHLOROETHANE	ND	0.005 mg/l
29V. TRICHLOROETHYLENE	BQL	0.001 mg/l
30V. TRICHLOROFLUOROMETHANE	ND	0.01 mg/l
31V. VINYL CHLORIDE	ND	0.01 mg/l



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CTEK REPORT 84-0814

U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 61
TULSA, OK 74121

NPDES PART 2C
PRIORITY POLLUTANTS

P.O. NUMBER: DACW63-84-M-1171

EHL SAMPLE #E2927

MATRIX - WATER

FIELD #6915
SITE 34 POND (WS-2)

ACID EXTRACTABLE COMPOUNDS

RESULTS

DETECTION LIMITS

1A. 2-CHLOROPHENOL	ND	0.03 mg/l
2A. 2,4-DICHLOROPHENOL	ND	0.03 mg/l
3A. 2,4-DIMETHYLPHENOL	ND	0.02 mg/l
4A. 4,6-DINITRO-O-CRESOL	ND	0.18 mg/l
5A. 2,4-DINITROPHENOL	ND	0.63 mg/l
6A. 2-NITROPHENOL	ND	0.04 mg/l
7A. 4-NITROPHENOL	ND	0.15 mg/l
8A. 4-CHLORO-3-METHYLPHENOL	ND	0.03 mg/l
9A. PENTACHLOROPHENOL	ND	0.11 mg/l
10A. PHENOL	0.13	0.02 mg/l
11A. 2,4,6-TRICHLOROPHENOL	ND	0.04 mg/l

BASE/NEUTRAL EXTRACTABLE COMPOUNDS

RESULTS

DETECTION LIMITS

1B. ACENAPHTHENE	ND	0.008 mg/l
2B. ACENAPHTYLENE	ND	0.014 mg/l
3B. ANTHRACENE	ND	0.008 mg/l
4B. BENZIDINE	ND	0.18 mg/l
5B. BENZO (a) ANTHRACENE	ND	0.031 mg/l
6B. BENZO (a) PYRENE	ND	0.010 mg/l
7B. 2,4-BENZOFUORANTHENE	ND	0.019 mg/l
8B. BENZO (ghi) PERYLENE	ND	0.016 mg/l
9B. BENZO (k) FLUORANTHENE	ND	0.010 mg/l
10B. BIS (2-CHLOROETHOXY) METHANE	ND	0.021 mg/l
11. BIS (2-CHLOROETHYL) ETHER	ND	0.023 mg/l
12B. BIS (2-CHLOROISOPROPYL) ETHER	ND	0.023 mg/l
13B. BIS (2-ETHYLHEXYL) PHTHALATE	ND	0.010 mg/l
14B. 4-BROMOPHENYL PHENYL ETHER	ND	0.008 mg/l
15B. BUTYL BENZYL PHTHALATE	ND	0.010 mg/l
16B. 2-CHLORONAPHTHALENE	ND	0.008 mg/l
17B. 4-CHLOROPHENYL PHENYL ETHER	ND	0.017 mg/l
18B. CHRYSENE	ND	0.010 mg/l
19B. DIBENZO (a,h) ANTHRACENE	ND	0.010 mg/l
20B. 1,2-DICHLOROBENZENE	ND	0.008 mg/l



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9742 SKILLMAN • DALLAS, TEXAS 75243 • 214/343-2025

CTEK REPORT 84-0814

U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 61
TULSA, OK 74121

NPDES PART 2C
PRIORITY POLLUTANTS

P.O. NUMBER: DACW63-84-M-1171

EHL SAMPLE #E2927

MATRIX - WATER

FIELD #6915
SITE 34 POND (WS-2)

<u>BASE/NEUTRAL EXTRACTABLE COMPOUNDS CONTINUED</u>	<u>RESULTS</u>	<u>DETECTION LIMITS</u>
21B. 1,3-DICHLOROBENZENE	ND	0.008 mg/l
22B. 1,4-DICHLOROBENZENE	ND	0.008 mg/l
23B. 3,3-DICHLOROBENZIDINE	ND	0.066 mg/l
24B. DIETHYL PHTHALATE	0.021	0.007 mg/l
25B. DIMETHYL PHTHALATE	ND	0.007 mg/l
26B. DI-N-BUTYL PHTHALATE	ND	0.010 mg/l
27B. 2,4-DINITROTOLUENE	ND	0.023 mg/l
28B. 2,6-DINITROTOLUENE	ND	0.008 mg/l
29B. DI-N-OCTYL PHTHALATE	ND	0.010 mg/l
30B. 1,2-DIPHENYL HYDRAZINE (AS AZOBENZENE)	ND	0.008 mg/l
31B. FLUORANTHENE	ND	0.009 mg/l
32B. FLUORENE	ND	0.008 mg/l
33B. HEXACHLOROBENZENE	ND	0.008 mg/l
34B. HEXACHLOROBUTADIENE	ND	0.004 mg/l
35B. HEXACHLOROCYCLOPENTADIENE	ND	mg/l
36B. HEXACHLOROETHANE	ND	0.006 mg/l
37B. INDENO (1,2,3-cd) PYRENE	ND	0.015 mg/l
38B. ISOPHORONE	ND	0.009 mg/l
39B. NAPHTHALENE	ND	0.006 mg/l
40B. NITROBENZENE	ND	0.008 mg/l
41B. N-NITRO-SODIMETHYLAMINE	ND	mg/l
42B. N-NITROSODI-N-PROPYLAMINE	ND	mg/l
43B. N-NITROSODIPHENYLAMINE	ND	0.008 mg/l
44B. PHENANTHRENE	ND	0.022 mg/l
45B. PYRENE	ND	0.008 mg/l
46B. 1,2,4-TRICHLOROBENZENE	ND	0.008 mg/l



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9742 SKILLMAN • DALLAS, TEXAS 75243 • 214/343-2025

CTEK REPORT 84-0814

U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 61
TULSA, OK 74121

NPDES PART 2C
PRIORITY POLLUTANTS

P.O. NUMBER: DACW63-84-M-1171

EHL SAMPLE #E2927

MATRIX - SOIL

FIELD #6915
SITE 34 POND (WS-2)

PESTICIDE COMPOUNDS

RESULTS

DETECTION LIMITS

1P. ALDRIN	ND	0.008 mg/l
2P. a-BHC	ND	mg/l
3P. B-BHC	ND	0.017 mg/l
4P. y-BHC	ND	mg/l
5P. o-BHC	ND	0.012 mg/l
6P. CHLORDANE	ND	mg/l
7P. 4,4-DDT	ND	0.019 mg/l
8P. 4,4-DDE	ND	0.022 mg/l
9P. 4,4-DDD	ND	0.011 mg/l
10P. DIELDRIN	ND	0.010 mg/l
11P. a-ENDOSULFAN	ND	mg/l
12P. B-ENDOSULFAN	ND	mg/l
13P. ENDOSULFAN SULFATE	ND	0.022 mg/l
14P. ENDRIN	ND	mg/l
15P. ENDRIN ALDEHYDE	ND	mg/l
16P. HEPTACHLOR	ND	0.008 mg/l
17P. HEPTACHLOR EPOXIDE	ND	0.009 mg/l
18P. PCB-1242	ND	0.12 mg/l
19P. PCB-1254	ND	0.14 mg/l
20P. PCB-1221	ND	0.12 mg/l
21P. PCB-1232	ND	0.12 mg/l
22P. PCB-1248	ND	0.14 mg/l
23P. PCB-1260	ND	0.14 mg/l
24P. PCB-1016	ND	0.12 mg/l
25P. TOXAPHENE	ND	mg/l

COMMENTS:

THANK YOU!

ROGER HALLSTEIN, Ph.D.
LABORATORY MANAGER



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CTEK REPORT 84-0814

U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 61
TULSA, OK 74121

NDPES PART 2C
PRIORITY POLLUTANTS

P.O. NUMBER: DACW63-84-M-1171

EHL SAMPLE #E2928

MATRIX - WATER

FIELD #6716
SITE 34 (34-SD-3)

VOLATILE COMPOUNDS

RESULTS

DETECTION LIMIT

1V. ACROLEIN	ND	0.01 mg/k
2V. ACRYLONITRILE	ND	0.01 mg/k
3V. BENZENE	.019	0.002 mg/k
4V. BIS (CHLOROMETHYL) ETHER	ND	0.014 mg/k
5V. BROMOFORM	ND	0.006 mg/k
6V. CARBON TETRACHLORIDE	ND	0.003 mg/k
7V. CHLOROBENZE	ND	0.003 mg/k
8V. CHLORODIBROMOMETHANE	ND	0.009 mg/k
9V. CHLOROETHANE	ND	0.009 mg/k
10V. 2-CHLOROETHYL VINYL ETHER	ND	0.014 mg/k
11V. CHLOROFORM	0.014	0.005 mg/k
12V. DICHLOROBROMOMETHANE	ND	0.003 mg/k
13V. DICHLORODIFLUOROMETHANE	ND	0.006 mg/k
14V. 1,1-DICHLOROETHANE	ND	0.003 mg/k
15V. 1,2-DICHLOROETHANE	ND	0.006 mg/k
16V. 1,1-DICHLOROETHYLENE	ND	0.003 mg/k
17V. 1,2-DICHLOROPROPANE	ND	0.006 mg/k
18V. 1,2-DICHLOROPROPYLENE	ND	0.011 mg/k
19V. ETHYLBENZENE	ND	0.003 mg/k
20V. METHYL BROMIDE	ND	0.006 mg/k
21V. METHYL CHLORIDE	ND	0.006 mg/k
22V. METHYLENE CHLORIDE	0.348	0.004 mg/k
23V. 1,1,2,2-TETRACHLOROETHANE	ND	0.004 mg/k
24V. TETRACHLOROETHYLENE	0.542	0.006 mg/k
25V. TOLUENE	0.367	0.002 mg/k
26V. 1,2-TRANS-DICHLOROETHYLENE	ND	0.003 mg/k
27V. 1,1,1-TRICHLOROETHANE	0.045	0.003 mg/k
28V. 1,1,2-TRICHLOROETHANE	ND	0.004 mg/k
29V. TRICHLOROETHYLENE	0.011	0.006 mg/k
30V. TRICHLOROFLUOROMETHANE	ND	0.014 mg/k
31V. VINYL CHLORIDE	ND	0.006 mg/k



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CTEK REPORT 84-0814

U.S. ARMY CORPS OF ENGINEERS

P.O. BOX 61

TULSA, OK 74121

NPDES PART 2C

PRIORITY POLLUTANTS

P.O. NUMBER: DACW63-84-M-1171

EHL SAMPLE #E2928

MATRIX - WATER

FIELD #6716

SITE 34 (34-SD-3)

ACID EXTRACTABLE COMPOUNDS

RESULTS

DETECTION LIMITS

1A. 2-CHLOROPHENOL	ND	0.3 mg/kg
2A. 2,4-DICHLOROPHENOL	ND	0.8 mg/kg
3A. 2,4-DIMETHYLPHENOL	ND	0.6 mg/kg
4A. 4,6-DINITRO-O-CRESOL	ND	3.3 mg/kg
5A. 2,4-DINITROPHENOL	ND	27 mg/kg
6A. 2-NITROPHENOL	ND	1.2 mg/kg
7A. 4-NITROPHENOL	ND	7.1 mg/kg
8A. 4-CHLORO-3-METHYLPHENOL	ND	0.7 mg/kg
9A. PENTACHLOROPHENOL	ND	1.1 mg/kg
10A. PHENOL	ND	0.6 mg/kg
11A. 2,4,6-TRICHLOROPHENOL	ND	0.7 mg/kg

BASE/NEUTRAL EXTRACTABLE COMPOUNDS

RESULTS

DETECTION LIMITS

1B. ACENAPHTHENE	ND	0.2 mg/kg
2B. ACENAPHTYLENE	ND	0.2 mg/kg
3B. ANTHRACENE	ND	0.2 mg/kg
4B. BENZIDINE	ND	3.0 mg/kg
5B. BENZO (a) ANTHRACENE	BQL	0.6 mg/kg
6B. BENZO (a) PYRENE	2.81	0.4 mg/kg
7B. 2,4-BENZOFUORANTHENE	ND	0.5 mg/kg
8B. BENZO (ghi) PERYLENE	3.51	0.6 mg/kg
9B. BENZO (k) FLUORANTHENE	4.96	0.5 mg/kg
10B. BIS (2-CHLOROETHOXY) METHANE	ND	0.6 mg/kg
11B. BIS (2-CHLOROETHYL) ETHER	ND	0.7 mg/kg
12B. BIS (2-CHLOROISOPROPYL) ETHER	ND	0.3 mg/kg
13B. BIS (2-ETHYLHEXYL) PHTHALATE	ND	0.5 mg/kg
14B. 4-BROMOPHENYL PHENYL ETHER	ND	0.3 mg/kg
15B. BUTYL BENZYL PHTHALATE	ND	0.3 mg/kg
16B. 2-CHLORONAPHTHALENE	ND	0.3 mg/kg
17B. 4-CHLOROPHENYL PHENYL ETHER	ND	0.4 mg/kg
18B. CHRYSENE	3.18	0.3 mg/kg
19B. DIBENZO (a,h) ANTHRACENE	10.7	1.0 mg/kg
20B. 1,2-DICHLOROBENZENE	ND	0.5 mg/kg



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CTEK REPORT 84-0814

U.S. ARMY CORPS OF ENGINEERS
P.O. BOX 61
TULSA, OK 74121

NPDES PART 2C
PRIORITY POLLUTANTS

P.O. NUMBER: DACW63-84-M-1171

EHL SAMPLE #E2928

MATRIX - WATER

FIELD #6716
SITE 34 (34-SD-3)

<u>BASE/NEUTRAL EXTRACTABLE COMPOUNDS CONTINUED</u>	<u>RESULTS</u>	<u>DETECTION LIMITS</u>
21B. 1,3-DICHLOROBENZENE	ND	0.5 mg/k
22B. 1,4-DICHLOROBENZENE	ND	0.4 mg/k
23B. 3,3-DICHLOROBENZIDINE	ND	mg/k
24B. DIETHYL PHTHALATE	ND	0.2 mg/k
25B. DIMETHYL PHTHALATE	ND	0.2 mg/k
26B. DI-N-BUTYL PHTHALATE	7.92	0.09 mg/k
27B. 2,4-DINITROTOLUENE	ND	3.3 mg/k
28B. 2,6-DINITROTOLUENE	ND	1.2 mg/k
29B. DI-N-OCTYL PHTHALATE	ND	0.1 mg/k
30B. 1,2-DIPHENYL HYDRAZINE (AS AZOBENZENE)	ND	mg/k
31B. FLUORANTHENE	ND	0.2 mg/k
32B. FLUORENE	ND	0.2 mg/k
33B. HEXACHLOROBENZENE	ND	0.2 mg/k
34B. HEXACHLOROBUTADIENE	ND	mg/k
35B. HEXACHLOROCYCLOPENTADIENE	ND	2.1 mg/k
36B. HEXACHLOROETHANE	ND	0.8 mg/k
37B. INDENO (1,2,3-cd) PYRENE	ND	mg/k
38B. ISOPHORONE	ND	0.3 mg/k
39B. NAPHTHALENE	16.3	0.2 mg/k
40B. NITROBENZENE	ND	0.8 mg/k
41B. N-NITRO-SODIMETHYLAMINE	ND	mg/k
42B. N-NITROSODI-N-PROPYLAMINE	ND	0.7 mg/k
43B. N-NITROSODIPHENYLAMINE	ND	0.5 mg/k
44B. PHENANTHRENE	ND	0.2 mg/k
45B. PYRENE	ND	0.3 mg/k
46B. 1,2,4-TRICHLOROBENZENE	ND	0.5 mg/k



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NPDES PART 2C
PRIORITY POLLUTANTS

P.O. NUMBER: DACW63-84-M-1171

EHL SAMPLE #E2928

MATRIX - SOIL

FIELD #6716
SITE 34 (34-SD-3)

PESTICIDE COMPOUNDS

RESULTS

DETECTION LIMITS

1P. ALDRIN	ND	0.2 mg/kg
2P. a-BHC	ND	mg/kg
3P. B-BHC	ND	0.4 mg/kg
4P. y-BHC	ND	0.6 mg/kg
5P. o-BHC	ND	0.2 mg/kg
6P. CHLORDANE	ND	mg/kg
7P. 4,4-DDT	ND	0.4 mg/kg
8P. 4,4-DDE	ND	0.4 mg/kg
9P. 4,4-DDD	ND	0.2 mg/kg
10P. DIELDRIN	ND	0.2 mg/kg
11P. a-ENDOSULFAN	ND	mg/kg
12P. B-ENDOSULFAN	ND	mg/kg
13P. ENDOSULFAN SULFATE	ND	0.4 mg/kg
14P. ENDRIN	ND	2.0 mg/kg
15P. ENDRIN ALDEHYDE	ND	mg/kg
16P. HEPTACHLOR	ND	1.0 mg/kg
17P. HEPTACHLOR EPOXIDE	ND	0.2 mg/kg
18P. PCB-1242	ND	3.0 mg/kg
19P. PCB-1254	ND	3.5 mg/kg
20P. PCB-1221	ND	3.0 mg/kg
21P. PCB-1232	ND	3.0 mg/kg
22P. PCB-1248	ND	3.5 mg/kg
23P. PCB-1260	ND	3.5 mg/kg
24P. PCB-1016	ND	3.0 mg/kg
25P. TOXAPHENE	ND	mg/kg

THANK YOU!

Roger E. Hallstein
ROGER HALLSTEIN, Ph.D.
LABORATORY MANAGER

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-5 (2pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 31 July 84
Received:

From: Chief
Geotechnical Branch
Tulsa District

MATERIAL: Soil
No. and type of samples: 10 jar samples
Source or other identification: Boring 7 thru 11

Date received: 27 July 84

REMARKS:

Results of Chemical Analysis of Soil Samples Table 1

Results of tests telephoned to TDO on 8 Aug. 84

Report sent to:

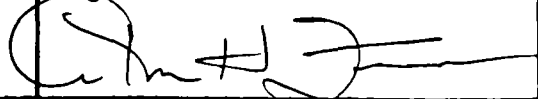
Tulsa District Office

Copy furnished:

Date:

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



Table

Pine Bluff Arsenal

Results of Chemical Analysis of Soil (1)

<u>SWD Lab No</u>	<u>Site Hole</u>	<u>Field No.</u>	<u>Depth</u>	<u>Ag</u>	<u>As</u>	<u>Ba</u>	<u>Cd</u>	<u>Cr</u>	<u>Hg</u>	<u>Pb</u>	<u>Se</u>	<u>Zn</u>	<u>pH</u>
7308	34- 7	J-1	5.5-5.8			130	0.5	6.0		11			
7309		J-2	5.8-5.9			.70	0.5	< 5.0		23			
7310	34- 8	J-1	4.2-4.4			570	14	1600		61			
7311		J-2	4.4-5.3			140	<.05	5.0		10			
7312	34- 9	J-1	3.8-4.0			95	<0.5	17		11			
7313		J-2	4.0-4.3			52	<0.5	6.9		14			
7314	34-10	J-1	4.3-4.5			210	1.8	120		37			
7315		J-2	4.5-5.0			86	0.6	7.1		10			
7316	34-11	J-1	4.4-4.8			230	1.3	150		20			
7317		J-2	4.8-5.7			77	<0.5	<5.0		5.7			

Minimum Reported Concentration
(1) Results reported in mg/kg

0.5 1.0 20.0 0.5 5.0 0.1 1.0 0.1 1.0

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-6 (3 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 31 July 84
Received:

From: Chief
Geotechnical Branch
Tulsa District

MATERIAL: Soil
No. and type of samples: 23 jars
Source or other identification: Holes 1 thru 4, 7 thru 11.

Date received: 17 Apr; 27 July 84

REMARKS:

Results of Chemical Analysis of Soil Samples Conducted by
Key Laboratory, Dallas, TX.

Results of tests telephoned to TDO on 29,31 Aug 84.

Report sent to:

Tulsa District

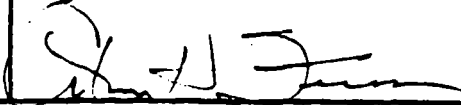
Copy furnished:

Date:

10 Sep 84

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



KEY LABORATORIES

Division of Production Profits

2636 WALNUT HILL LANE SUITE 275
DALLAS, TEX. 75229 214/350-5841

September 4, 1984

REPORT OF ANALYSIS

NUMBER: GH-4020

CLIENT: U.S. Army Corps of Engineers
Southwest Division Laboratory
4815 Cass Street
Dallas, Texas 75235
Attention: Mr. Jeffrey Tye

DESCRIPTION: The client submitted thirty-seven soil samples for determination of various parameters. The descriptions of the samples are given on the data sheet.

PROCEDURE: The samples were extracted with hexane and analyzed on a Varian 6000 gas chromatograph under the following conditions:

Column	<u>1</u> SPB-5 Capillary	<u>2</u> SPB-5 Capillary
Detector	ECD at 310°C	FID at 310°C
Column Temp.	45-230°C	45-300°C
Attenuation	1	1

RESULTS: See attached data sheet.

Submitted by:

KEY LABORATORIES



Steve T. Jones, Senior Chemist

STJ/kb

U.S. ARMY CORPS OF ENGINEERS

<u>IDENTIFICATION</u>	<u>METHYLENE CHLORIDE</u>	<u>TETRACHLORO- ETHYLENE</u>	<u>TOLUENE</u>	<u>DIBENZ(A,H)ANTHRACENE</u>
6229 34-1, Jar-1	0.09	0.010	<0.09	0.04
6231 " Jar-3	<0.005	0.004	0.23	3.8
6233 " Jar-5	0.02	0.004	0.21	2.7
6235 " Jar-7	0.04	0.004	<0.09	2.0
6247 34-2, Jar-1	0.05	0.004	0.22	2.4
6249 " Jar-3	0.02	0.004	0.38	3.3
6252 " Jar-6	0.02	0.004	0.23	4.0
6253 34-3, Jar-1	0.02	0.004	0.24	1.0
6255 " Jar-3	0.03	0.002	0.22	0.83
6257 " Jar-5	0.17	0.005	0.42	1.2
6258 34-4, Jar-1	0.02	0.004	0.32	0.83
6259 " Jar-3	<0.005	0.008	0.44	1.4
6262 " Jar-6	0.02	0.004	0.37	0.85
7308 34-7, Jar-1	<0.005	0.006	0.29	0.52
7309 " Jar-2	0.25	0.005	0.48	1.8
7310 34-8, Jar-1	<0.005	0.005	0.29	0.89
7311 " Jar-2	0.17	0.004	0.39	0.57
7312 34-9, Jar-1	0.88	0.004	0.26	1.0
7313 " Jar-2	1.6	0.005	0.35	0.44
7314 34-10, Jar-1	0.10	0.002	0.22	1.5
7315 " Jar-2	0.05	0.003	0.08	0.40
7315 Duplicate	0.10	0.003	<0.04	0.23
7316 34-11, Jar-1	0.06	0.004	0.23	0.82
7317 Jar-2	0.05	0.003	0.19	1.1

Results reported in parts per million.

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-7 (4 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 28 Sept 84
Received:

From: Chief
Geotechnical Branch
Tulsa District

MATERIAL: Soil and Water
No. and type of samples: 6 jar samples
Source or other identification: Holes: 12 and 13

Date received: 24 Sept 84

REMARKS:

Results of Chemical Analysis of Soil Samples Table 1

Note: The 13 soil and 1 water sample alluded to in the Key Laboratories Report of Analysis included 7 soil sample from Site 38 (SWDED-GL Report 13759-7).

Results of tests telephoned to TDO on 25 Oct 84

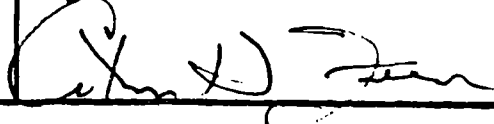
Report sent to:
Tulsa District Office

Copy furnished:

Date:
29 Oct 84

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



October 22, 1984

REPORT OF ANALYSIS

NUMBER: GJ-4054

CLIENT: U.S. Army Corps of Engineers
Southwest Division Laboratory
4815 Cass Street
Dallas, Texas 75235
Attention: Mr. Jeffrey Tye

DESCRIPTION: The client submitted thirteen soil samples and one water sample for determination of various parameters. The descriptions of the samples are given on the data sheet.

PROCEDURE: The samples were extracted with hexane and analyzed on a Varian 6000 gas chromatograph under the following conditions:

Column	<u>1</u> SPB-5 Capillary	<u>2</u> SPB-5 Capillary
Detector	ECD at 310 C	FID at 310 C
Column Temp.	45-230 C	45-300 C
Attenuation	1	1

RESULTS: See attached data sheet.

Submitted by:

KEY LABORATORIES



Steve T. Jones, Senior Chemist

STJ/kb

U.S. ARMY CORPS OF ENGINEERS

Table-1

<u>Sample</u>	<u>Methylene Chloride</u>	<u>Tetrachloroethylene</u>	<u>Toluene</u>	<u>Dibenzo (a,h) anthracene</u>
7708	<0.5	<0.1	<0.5	<0.03
7709	<0.5	1.0	<0.5	<0.03
7718	<0.5	1.3	<0.5	<0.03
7722	<0.5	1.2	<0.5	<0.03
7723	<0.5	1.3	<0.5	<0.03
32	<0.5	1.3	<0.5	13
7732 *	<0.5	1.1	<0.5	13

* Denotes duplicate analysis

Results are reported in parts per million

Sample No. 7708-Hole 12, J-4, 9.0'-11.0'
Sample No. 7709-Hole 12, J-5, 11.0'-14.0'
Sample No. 7718-Hole 12, J-14, 35.0'-38.5'
Sample No. 7722-Hole 13, J-3, 6.0'-9.0'
Sample No. 7723-Hole 13, J-4, 9.0'-13.0'
Sample No. 7732-Hole 13, J-13, 33.0'-36.0'

U.S. ARMY CORPS OF ENGINEERS

Table 1

<u>Sample</u>	<u>Methylene Chloride</u>	<u>Tetrachloroethylene</u>	<u>Toluene</u>	<u>Dibenzo (a,h) anthracene</u>
7719	<0.08	0.18	<0.07	<0.05
7719 *	<0.08	0.26	<0.07	<0.05

* Denotes duplicate analysis

Results are reported in milligrams per liter

Sample from Site 34, hole 13, field No. WS-1

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-8 (2 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 12 Oct 84
Received:

From: Chief
Geotech Branch
Tulsa District

MATERIAL: Soil

No. and type of samples: 15 jar samples

Source or other identification: Holes: 12, 13 and 14

Date received: 24 Sept, 24 Oct 84

REMARKS:

Results of Classification Tests

Table 1

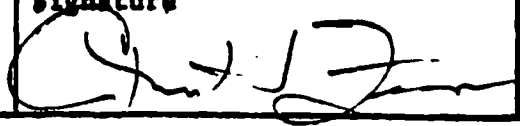
Report sent to:
Tulsa District

Copy furnished:

Date:
28 Nov 84

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



BORING NO.	FLO NO.	SWD NO.	DEPTH, FT.	GR	SA	FI	LL	PL	PI	LS	MC, %	PCF	MAJOR TESTS	DESCRIPTION OF MATERIAL
PINE BLUFF ARSENAL-SITE 34														
12	J-1	6/7705	0.0-3.6	0	10	90	NP	NP	NP	3	23.5			ML - SILT, GRAY, MOIST.
12	J-2	6/7706	3.6-6.0	0	78	22	37	20	17	5	34.3			SC - SAND, CLAYEY, GRAYISH BROWN, MOIST.
12	J-5	6/7709	11.0-14.0											CL - CLAY, SANDY, GRAY, MOIST, INSUFFICIENT MATERIAL FOR CLASSIFICATION TESTS.
12	J-6	6/7710	14.0-17.0	0	18	82	42	25	17	7	37.2			CL - CLAY, BROWN, MOIST.
12	J-8	6/7712	20.0-23.0	0	17	83	56	32	24	2	37.6			MH - SILT, GRAYISH BROWN, MOIST
12	J-10	6/7714	26.0-29.0	0	20	80	71	30	41	15	45.0			CH - CLAY, GRAYISH BROWN, MOIST.
12	J-12	6/7716	31.0-33.0	0	22	78	55	22	33	12	35.9			CH - CLAY, SANDY, GRAYISH BROWN, MOIST.
13	J-1	6/7720	0.0-3.0	0	8	92	22	20	2	2	21.2			ML - SILT, GRAY, MOIST.
13	J-4	6/7723	9.0-13.0											ML - SILT, GRAY, MOIST, INSUFFICIENT MATERIAL FOR CLASSIFICATION TESTS.
13	J-5	6/7724	13.0-16.5	0	9	91	59	32	27	2	39.4			MH - SILT, BROWN, MOIST.
13	J-7	6/7726	17.5-21.0	0	17	83	34	27	7	6	34.5			ML - SILT, BROWN, MOIST.
13	J-9	6/7728	23.0-26.0	0	15	85	58	31	27	11	37.2			MH - SILT, GRAY, MOIST.
14	J-1	6/7995	0.0-3.0											CL - CLAY, GRAY, MOIST.
14	J-3	6/7997	6.0-9.0											CL - CLAY, LIGHT GRAYISH BROWN, MOIST.
14	J-5	6/7999	12.0-14.0											CL - CLAY, GRAY TO LIGHT GRAYISH BROWN, MOIST.

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-9 (2 pages) .

PROJECT: Pine Bluff Arsenal
Feature: Closed Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 19 Oct 84
Received:

From: Chief
Geotechnical Branch
Tulsa District

MATERIAL: Undisturbed Soil Samples
No. and type of samples: 2 Denison samples
Source or other identification: Boring 14

Date received: 19 Oct 84

REMARKS:

Results of Tests

Table 1

Report sent to:
Tulsa District

Copy furnished:

Date:
05 Dec 84

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



BORING NO.	FLD NO.	SUB NO.	DEPTH, FT.	GR	SA	FI	LL	PL	PI	LS	WC, %	PCF	K, CM/SEC	DESCRIPTION OF MATERIAL
PINE BLUFF ARSENAL - CLOSED HAZARDOUS WASTE SITE 34														
16	DB-9	94/6429	33.0-35.0	0	41	59	NP	NP	NP	1	42.7	75		ML - SILT WITH SHALE SEAMS TO 1/2" SANDY, GRAY, MOIST, TRACES OF ORGANIC MATTER, FRACTURED, BRILLING DISTURBED. UNABLE TO TRIM PERMEABILITY TEST SPECIMEN BECAUSE OF FRACTURES AND DISTURBANCE.
10	DB-10	94/6430	36.3-38.3	0	49	51	43	20	23	5	31.0	89	9.5 x 10-6	CL - CLAY, SANDY, GRAY, MOIST, ORGANIC SEAMS THROUGHOUT, FEW THIN SHALE SEAMS TO 1/8".

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-10 (2 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 20 Nov 84
Received:

From: Chief
Geotechnical Branch
Tulsa District

MATERIAL: Soil
No. and type of samples: 2 jar samples
Source or other identification: Hole 13

Date received: 24 Sep 84

REMARKS:

Results of Chemical Analysis of Soil Samples Table 1

Tests conducted by Allied Analytical and Research Laboratory, Dallas, TX.

Results of tests telephoned to TDO on 06 Dec 84.

Report sent to:

Tulsa District Office

Copy furnished:

Date:

08 Jan 85

Name and title:
ARTHUR H. FEESE
Director
SWD Laboratory

Signature



ALLIED ANALYTICAL & RESEARCH LABORATORIES

Chenail

214/237-8996

DATE SUBMITTED 11/21/84

ANALYTICAL REPORT NO. 63720

ADDRESS

U.S.E.P.A. Method 8270
Dibenzo (a,h) anthracene

Sample ID	MDL, ppb	Conc. ppb
PBA 34-13 32.0-33.0 12 of 14	1700	NA
PBA 34-13 36.0-39.0 14 of 14	1900	NA

NA = Below minimum detectable level (MDL)

H. Morris Weller, President

ALLIED ANALYTICAL & RESEARCH LABORATORIES, BY.

THIS REPORT DOES NOT CONSTITUTE APPROVAL OR AN ENDORSEMENT. ALL OR ANY PART MAY NOT BE REPRODUCED OR USED IN ADVERTISING UNLESS AUTHORIZED BY THE DIRECTOR OF THE LABORATORY.

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 Cass Street
Dallas, Texas 75235

SUBMITTAL OF SWDED-GL REPORT 13758-71 (2 pages)

PROJECT: Pine Bluff Arsenal
Feature: Close Hazardous Waste Site 34

Contract No.:

TEST REQUEST NO.: Telephone
Dated: 20 March 85
Received:

From: Chief
Geotechnical Branch
Tulsa District

MATERIAL: Soil
No. and type of samples: 8 Jars
Source or other identification: Borings; 7 thru 11

Date received: 27 July 84

REMARKS:

Results of Tests of Soil for EP Toxicity Table 1

Results of tests telephoned to TDO on 27 March 1985.

Report sent to:

Tulsa District

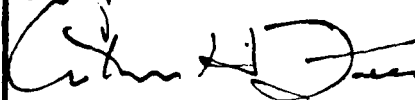
Copy furnished:

Date:

23 Apr 85

Name and title:
ARTHUR H. YERSE
Director
SWD Laboratory

Signature



Results of Chemical Analysis of Soil for EP Toxicity⁽¹⁾

Hole	Field No.	SWD No.	Depth	Ag	As	Ba	Cd	Cr	Hg	Pb	Se
34-7	J-1	7308	5.5-5.8	<0.01	0.016	<0.50	0.005	<0.01	0.0012	0.06	<0.0004
8	J-1	7310	4.2-4.4	Insufficient material for testing.							
8	J-2	7311	4.4-5.3	<0.01	0.001	<0.50	0.005	<0.01	0.0008	<0.01	<0.0004
9	J-1	7312	3.8-4.0	Insufficient material for testing.							
9	J-2	7313	4.0-4.3	<0.01	<0.001	<0.50	0.005	<0.01	<0.0001	0.07	<0.0004
10	J-1	7314	4.3-4.5	Insufficient material for testing.							
10	J-2	7315	4.5-5.0	<0.01	<0.001	<0.50	0.003	<0.01	<0.0001	0.04	<0.0004
11	J-1	7316	4.4-4.8	<0.01	0.005	<0.50	0.010	<0.01	<0.0001	0.05	<0.0004

Minimum Reported Concentration
EP Toxicity Limits

0.01	0.001	0.50	0.002	0.01	0.0001	0.01	0.0004
5.0	5.0	100.0	1.0	5.0	0.2	5.0	1.0

(1) Results reported in mg/l.

APPENDIX II

BORING - CONTAMINANT PLOTS

LEGEND



CONTAMINATED DEBRIS AND RUBBLE



SAND AND GRAVEL



SILT AND SANDY CLAY



CLAY



CLAY SHALE OR SILTSTONE
OF THE JACKSON GROUP



SAND OR POORLY CEMENTED SANDSTONE
OF THE JACKSON GROUP



MIDDEPTH OF SOIL SAMPLE TESTED



BACKGROUND LIMIT

Average concentration of contaminant in
soil at Pine Bluff Arsenal.
(or minimum detectable value)

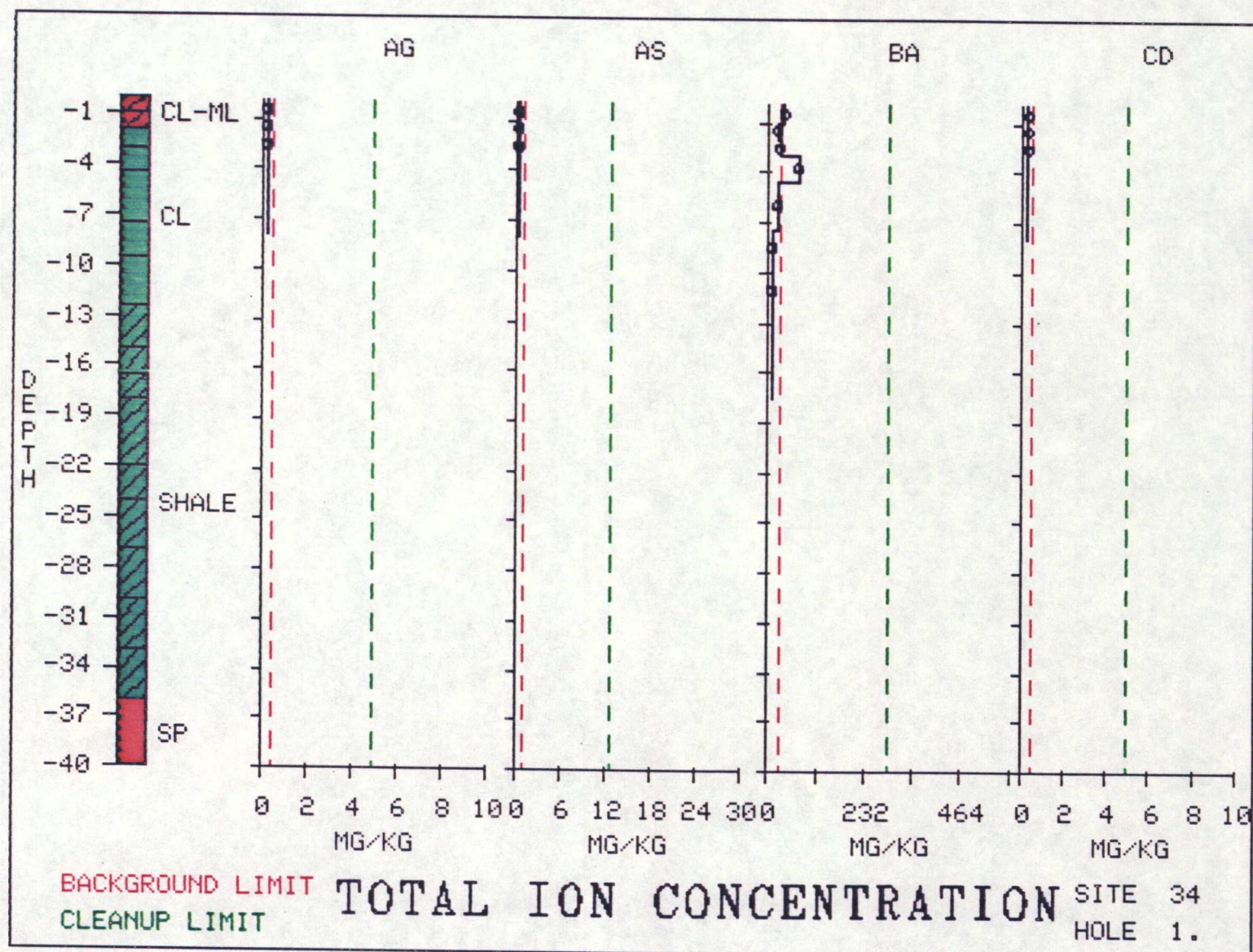


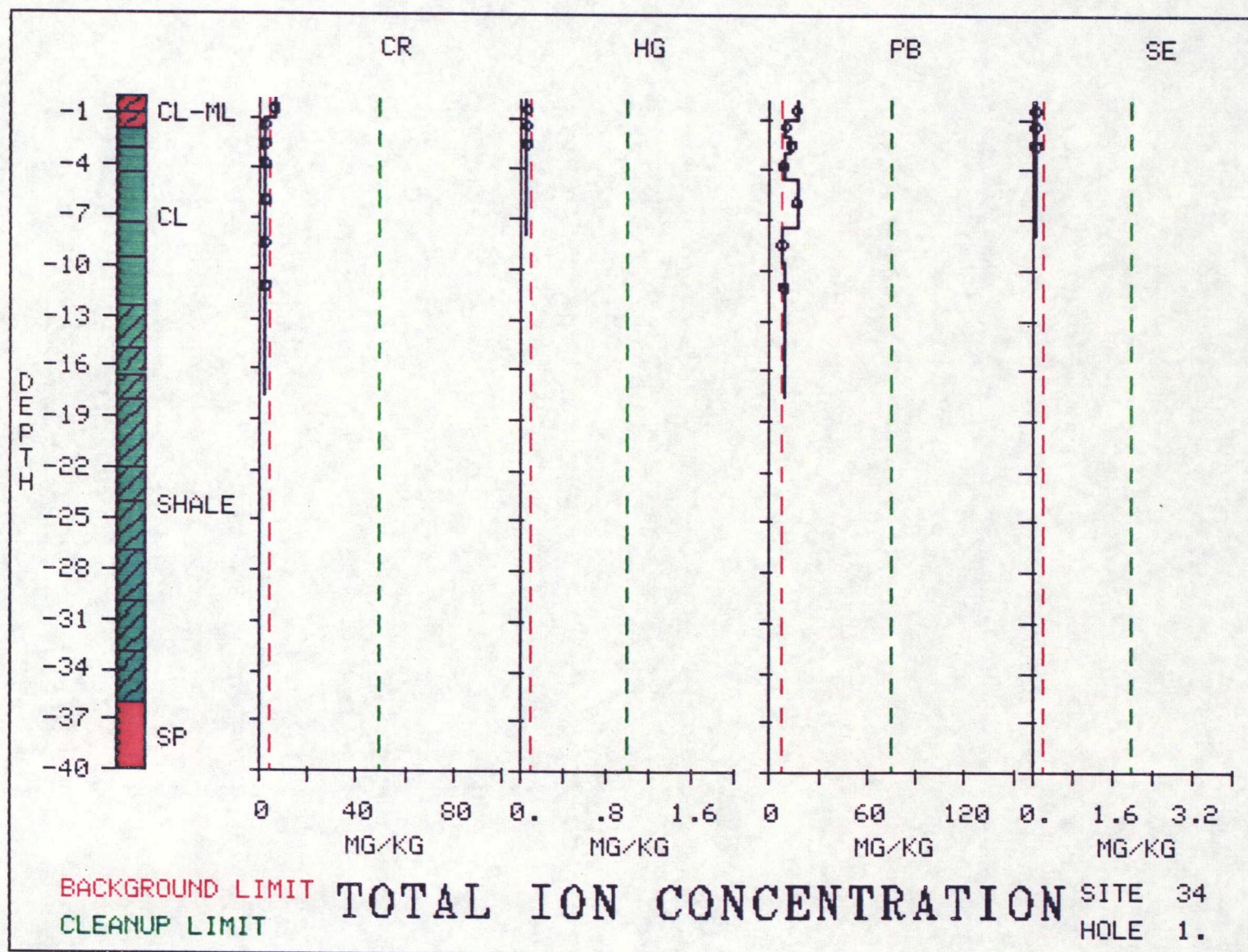
CLEANUP LIMIT

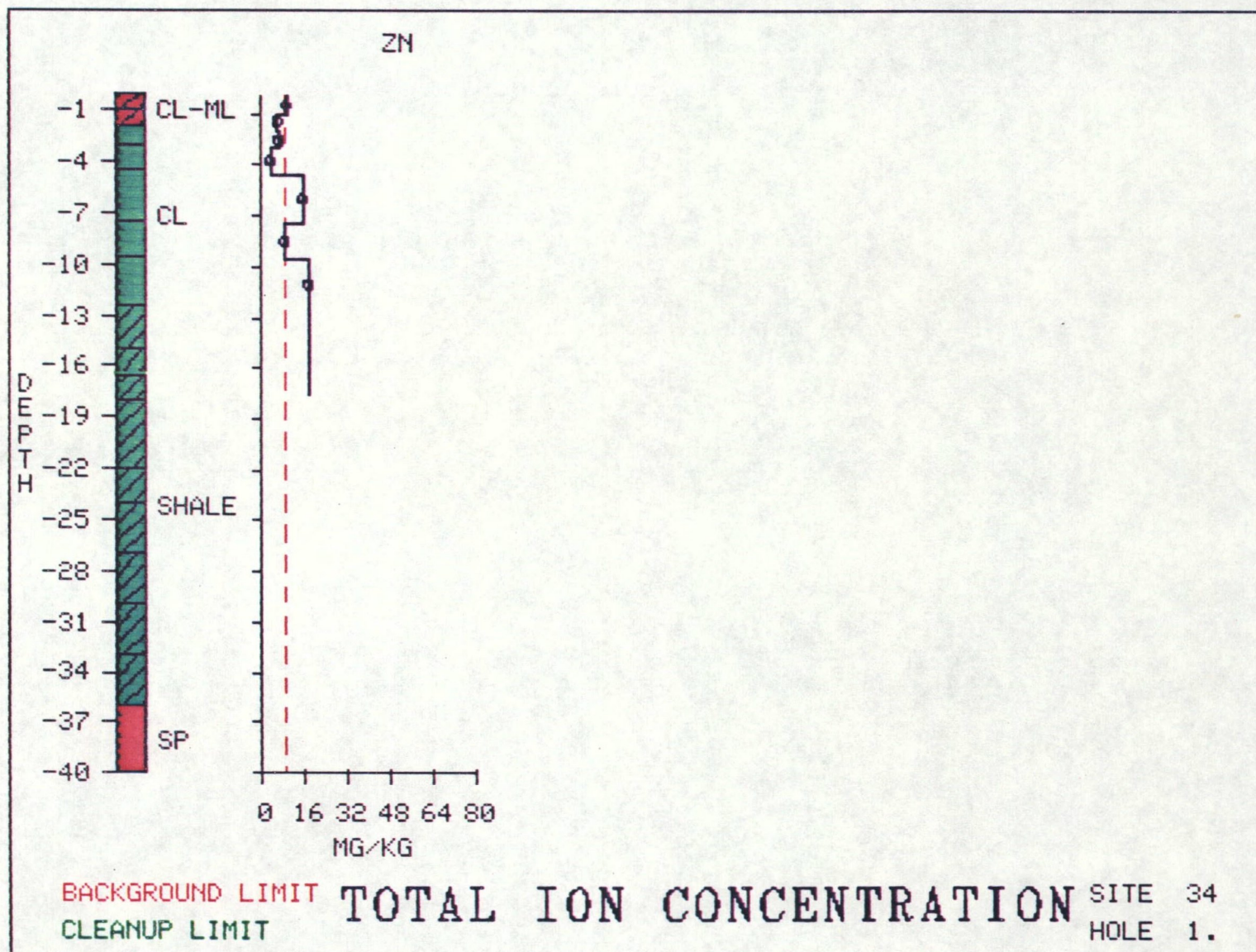
Concentration to which site will be cleaned up
(10 times background limit). The color "red"
to the right of the cleanup limit indicates
contamination.

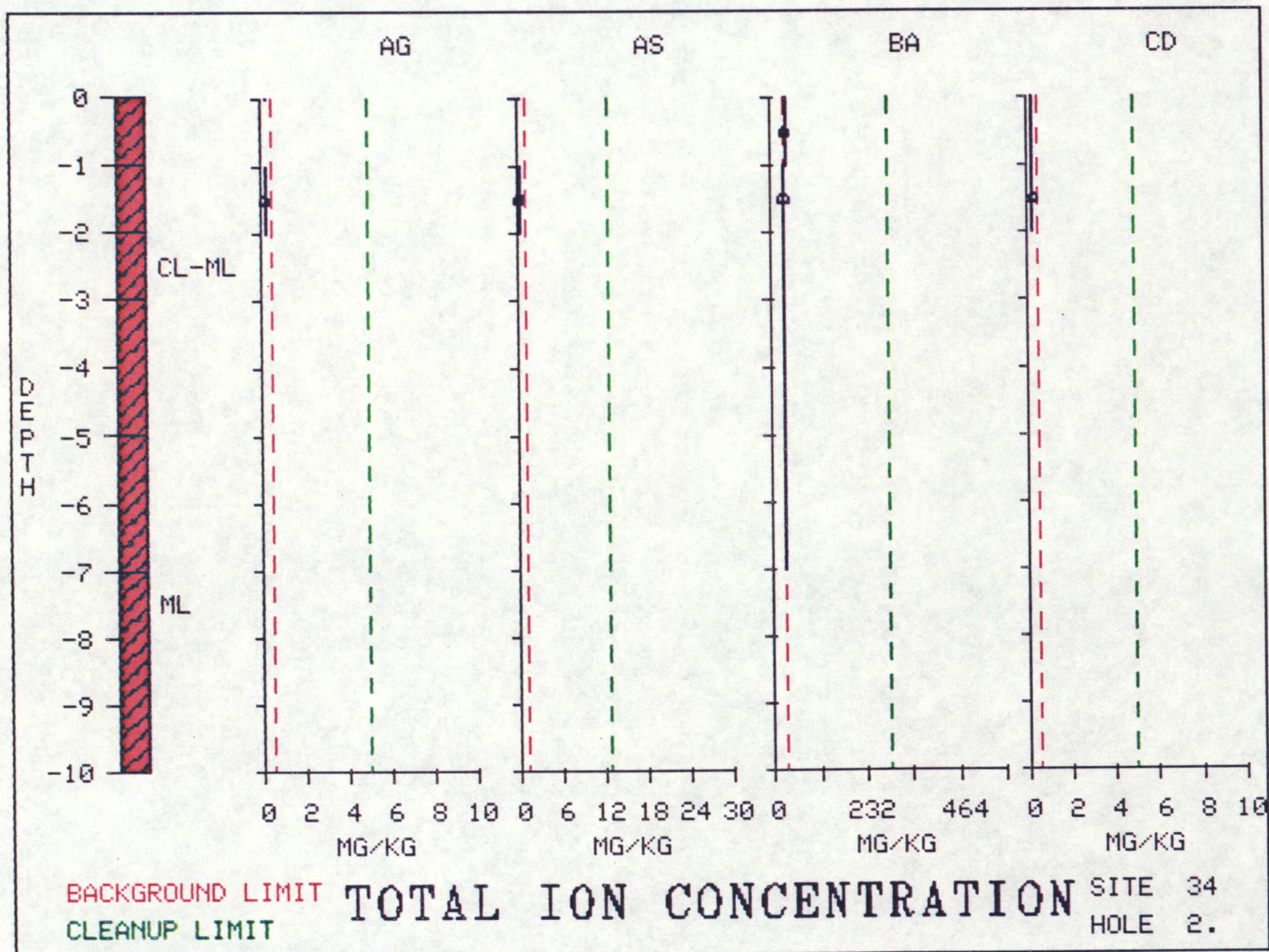
*EP

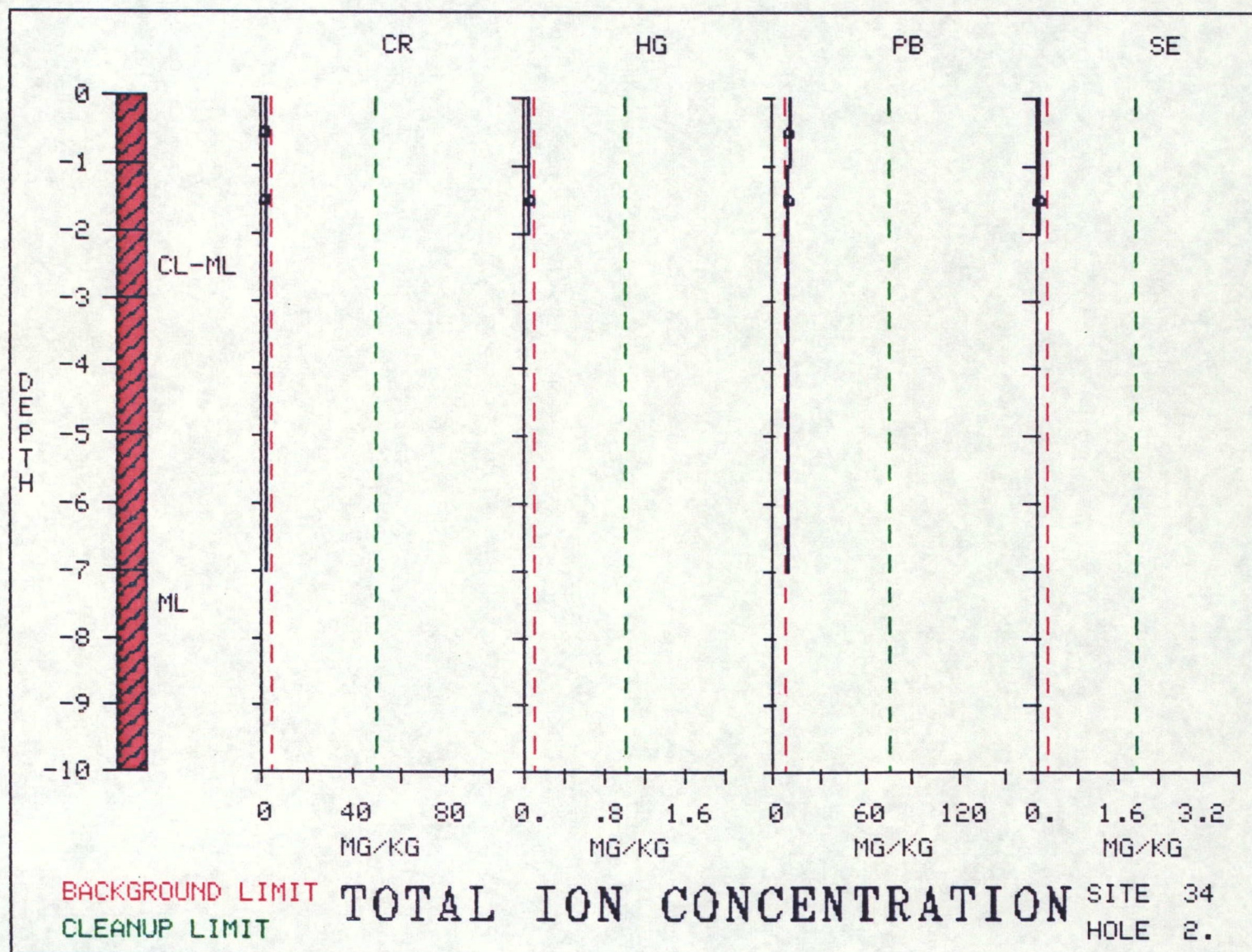
LOCATION OF SAMPLE TESTED FOR EP TOXICITY

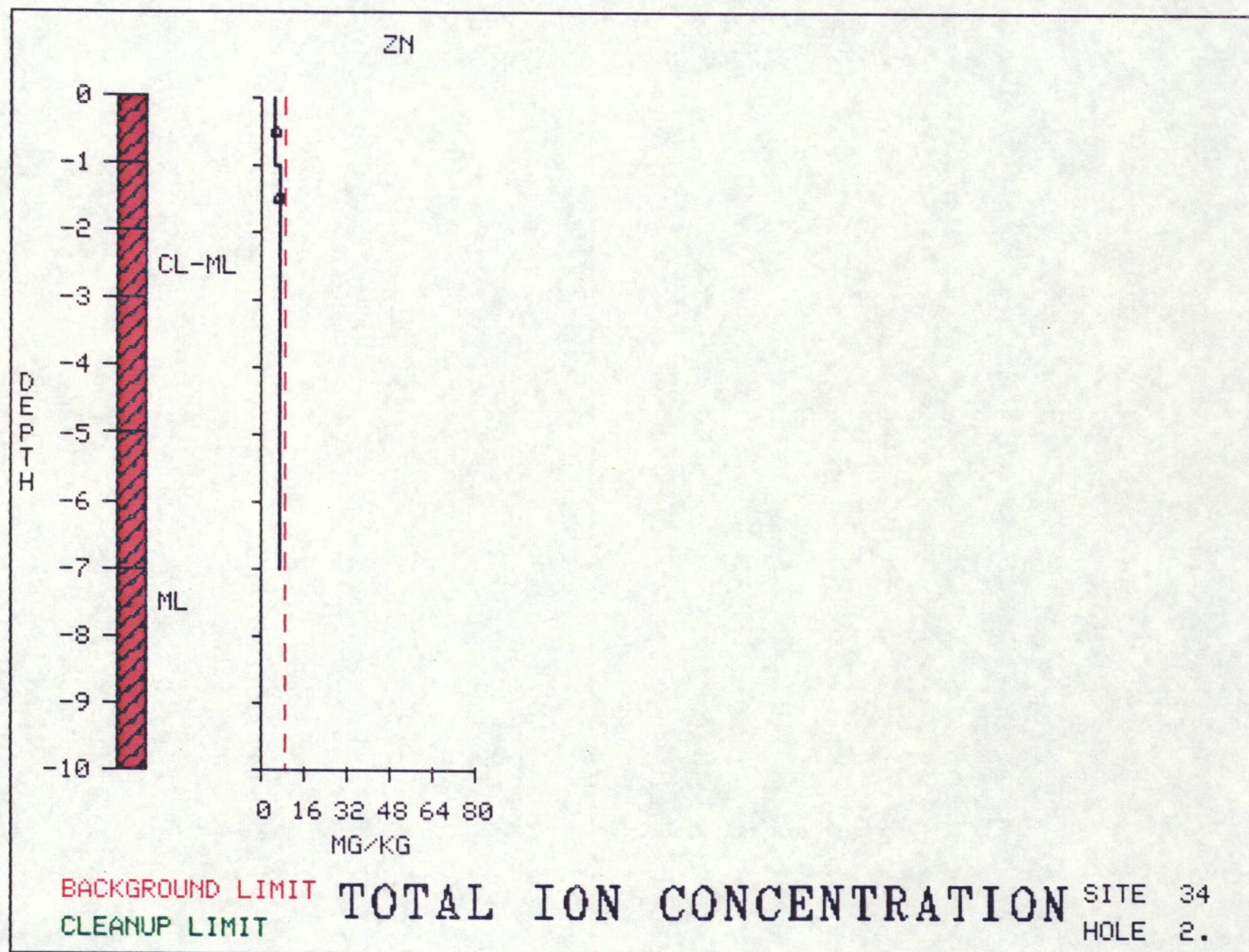


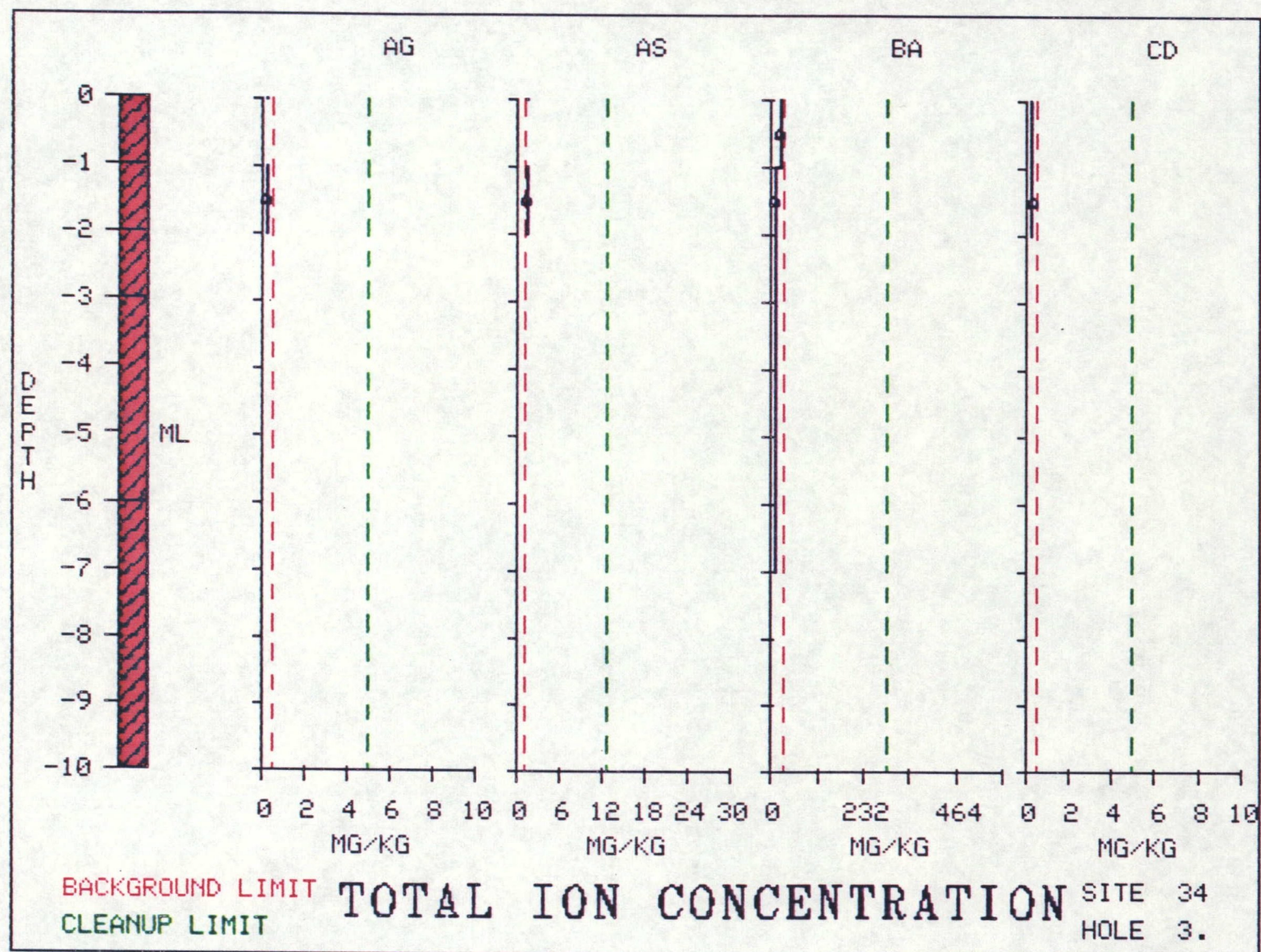


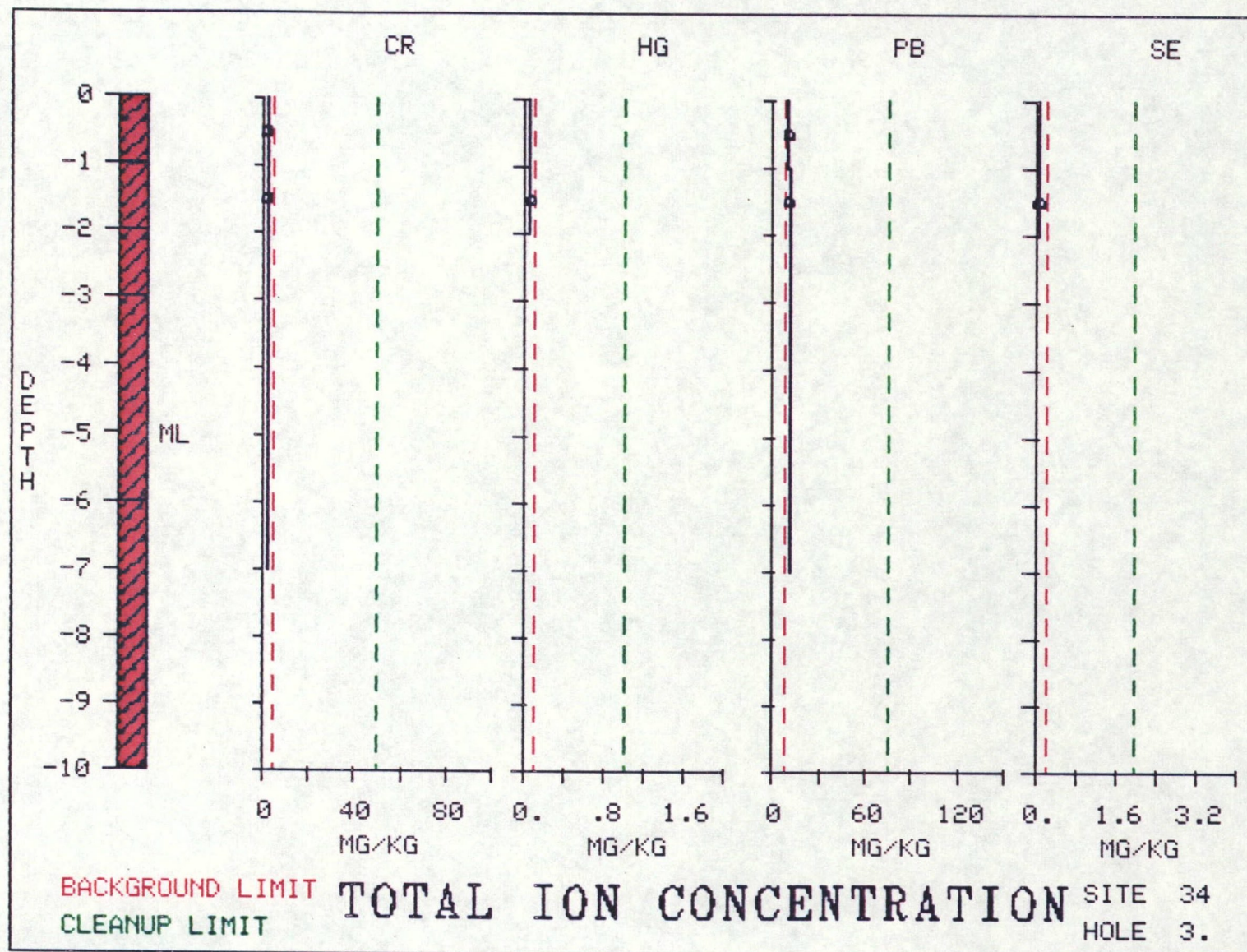


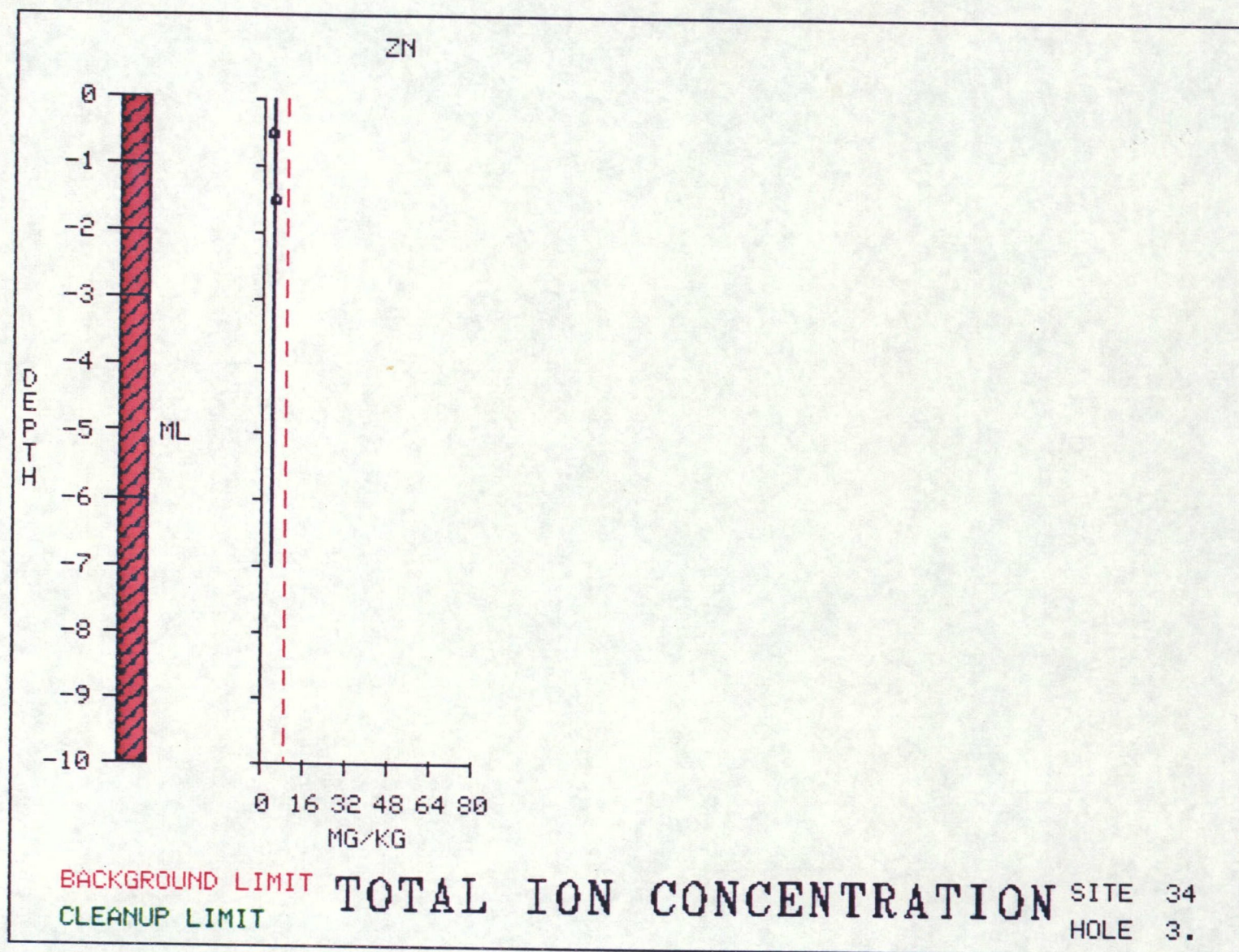


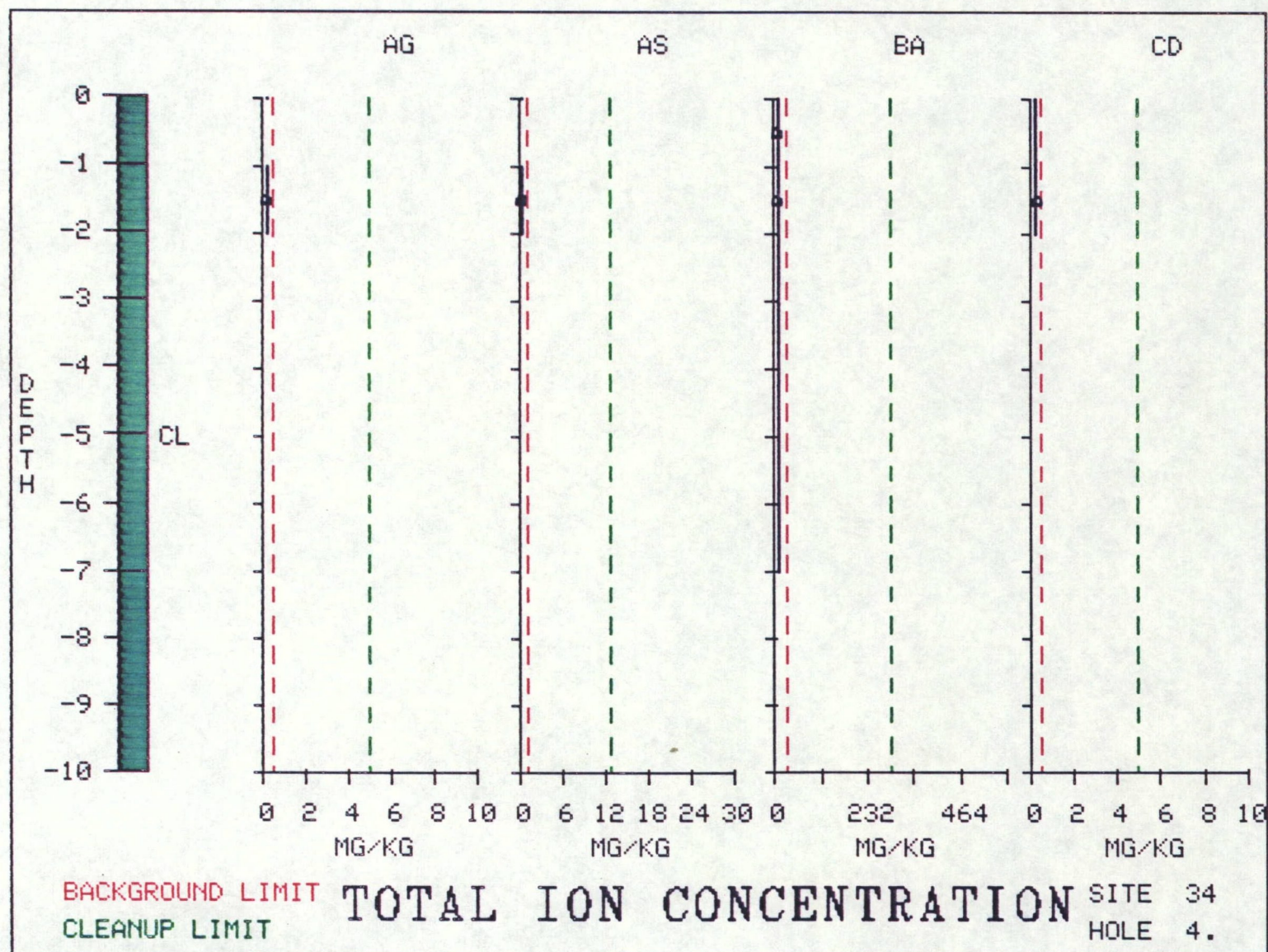


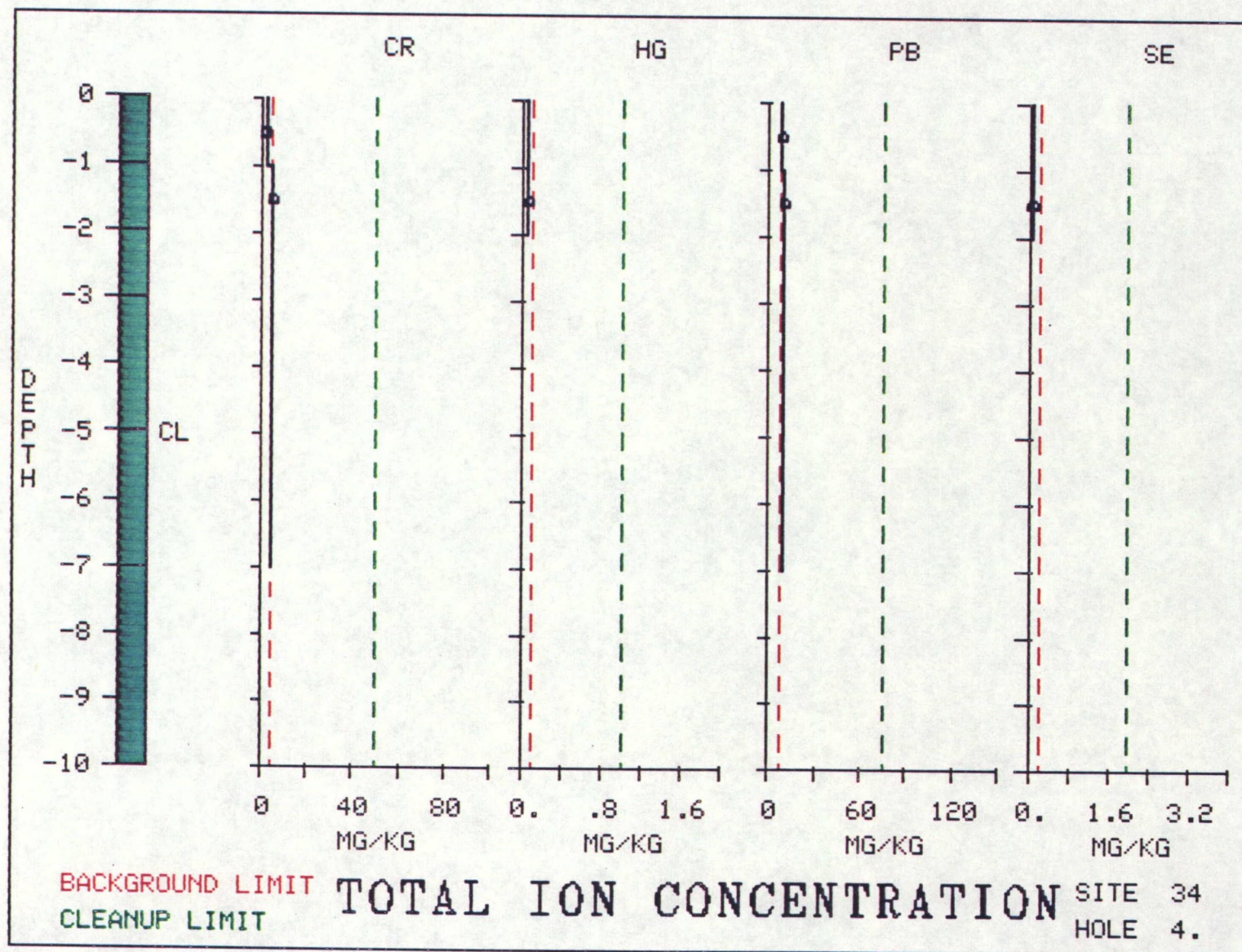


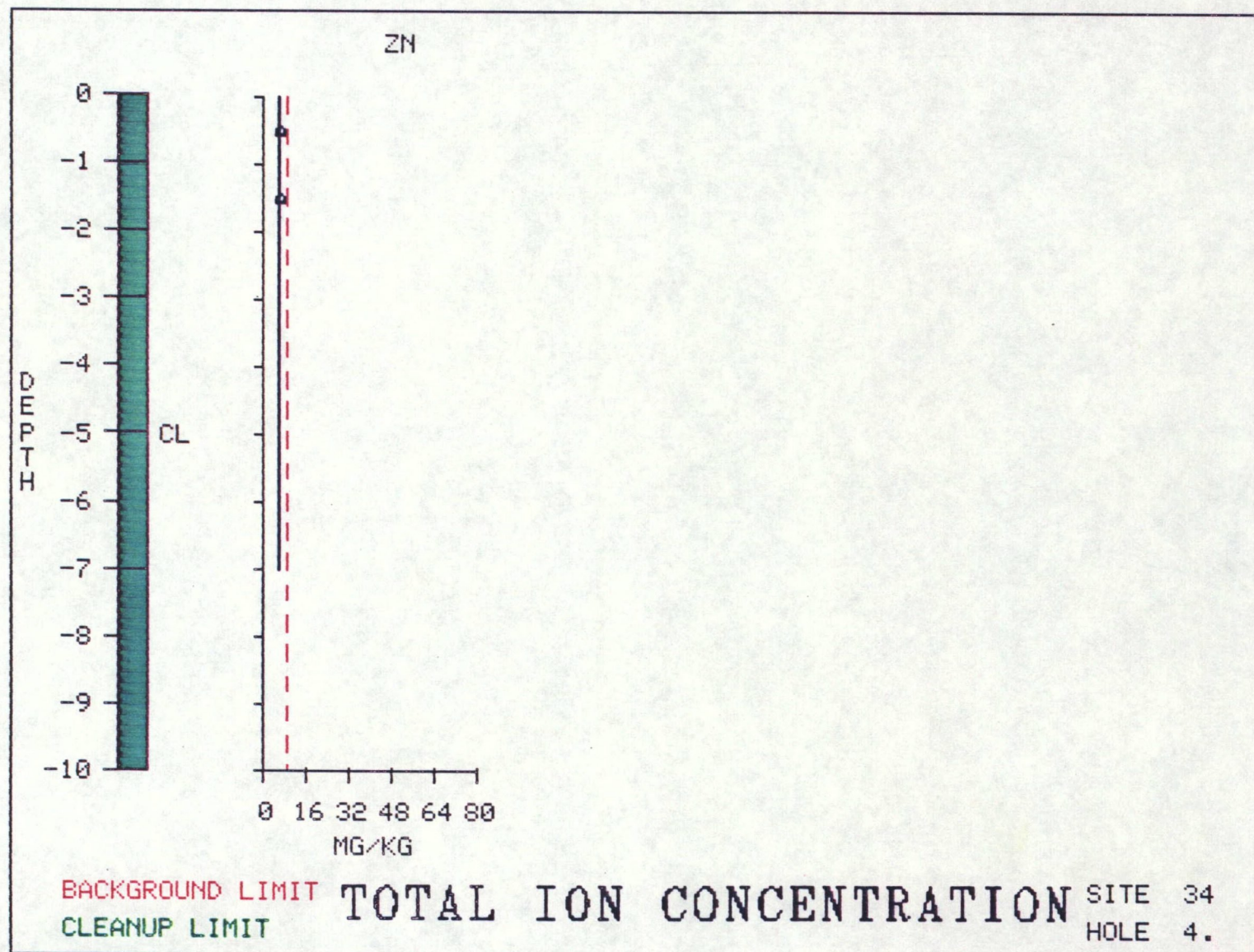


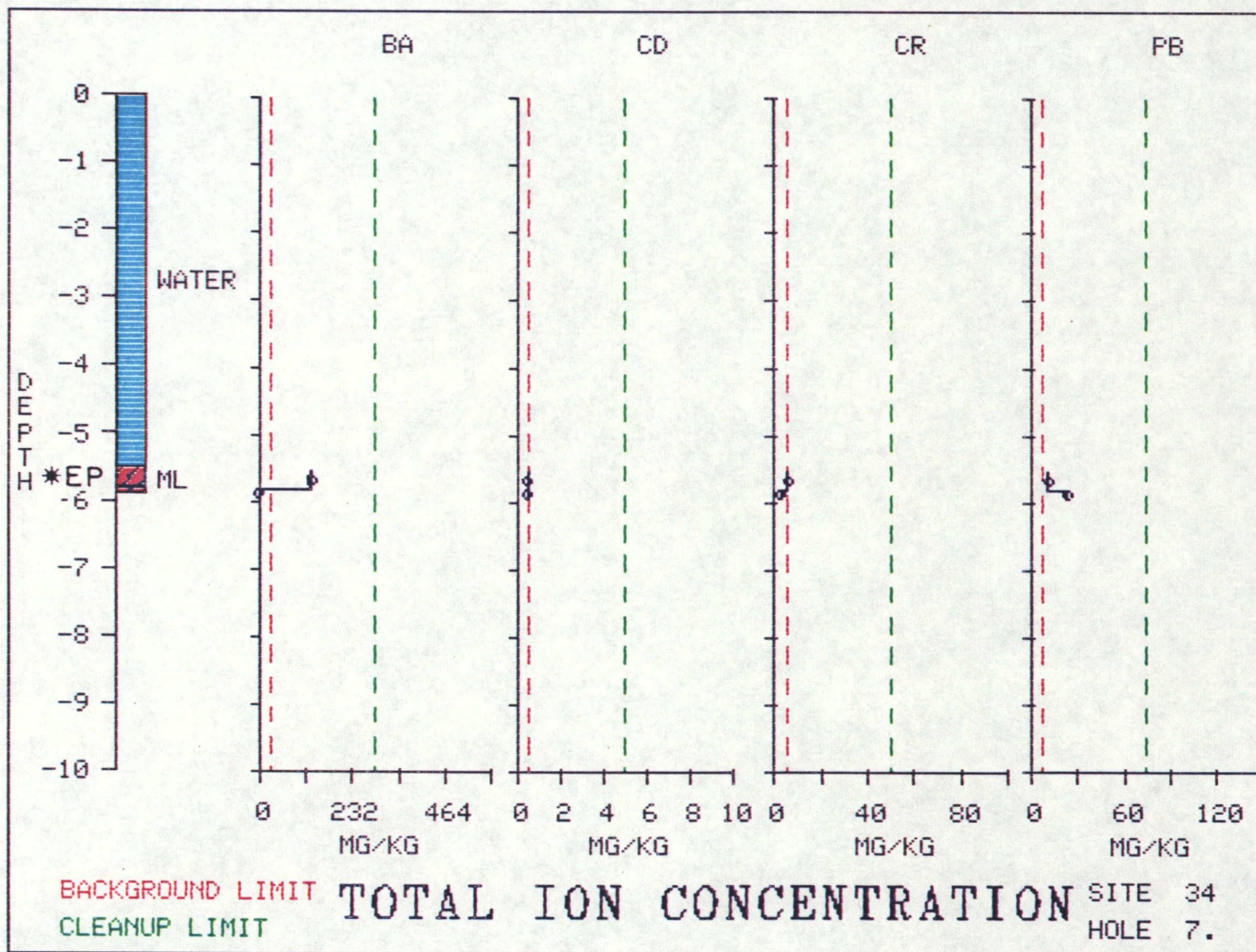


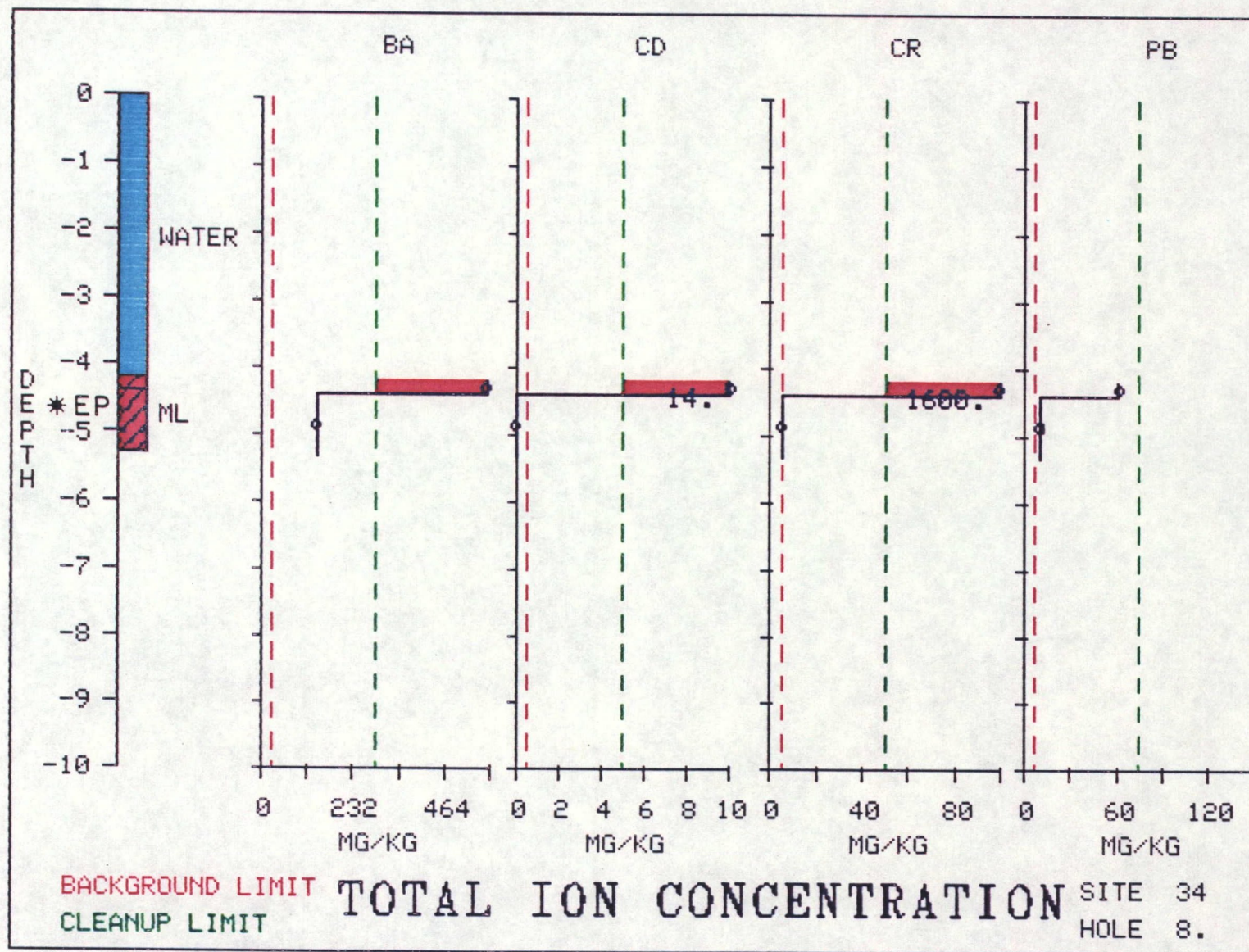


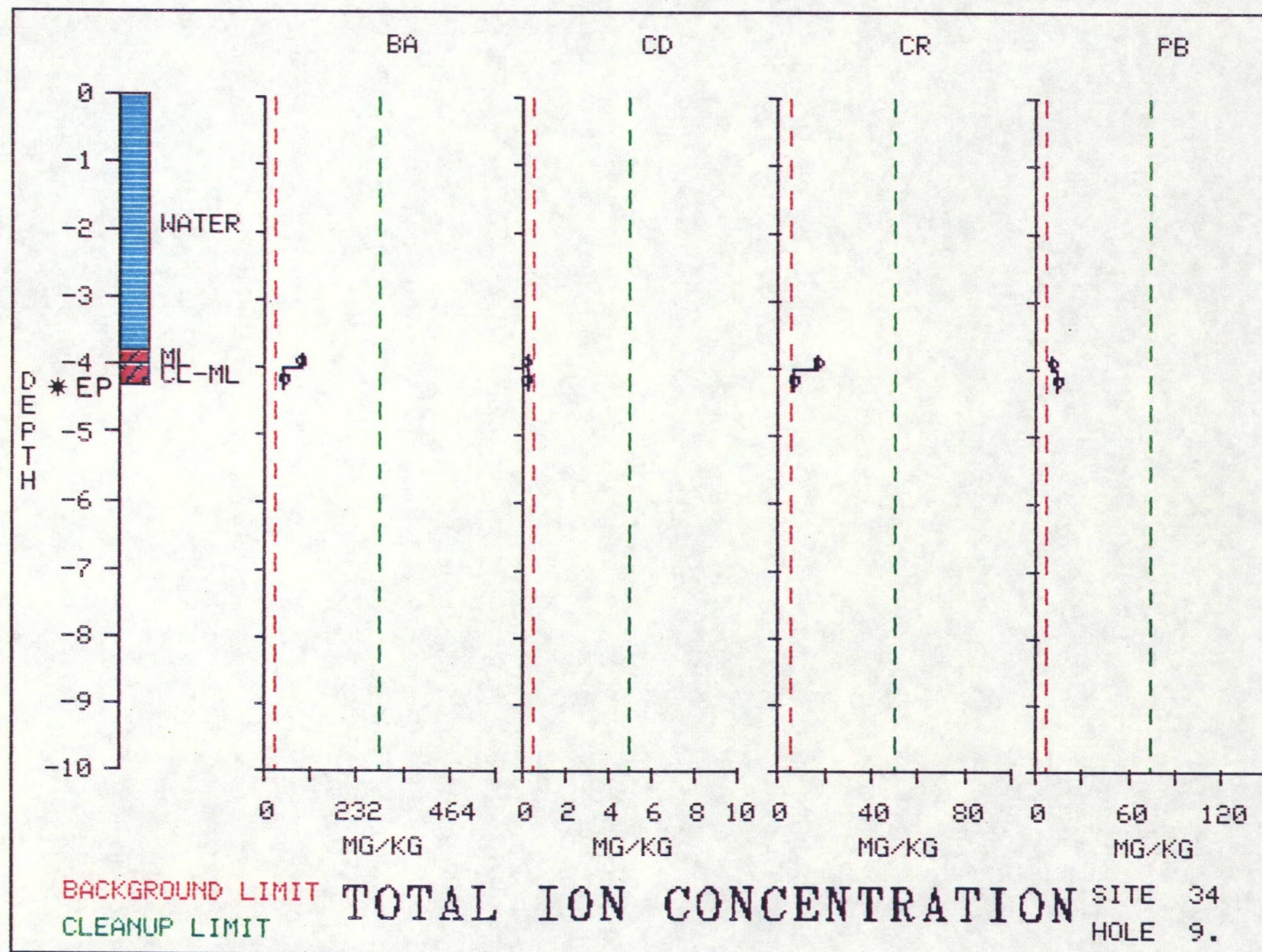


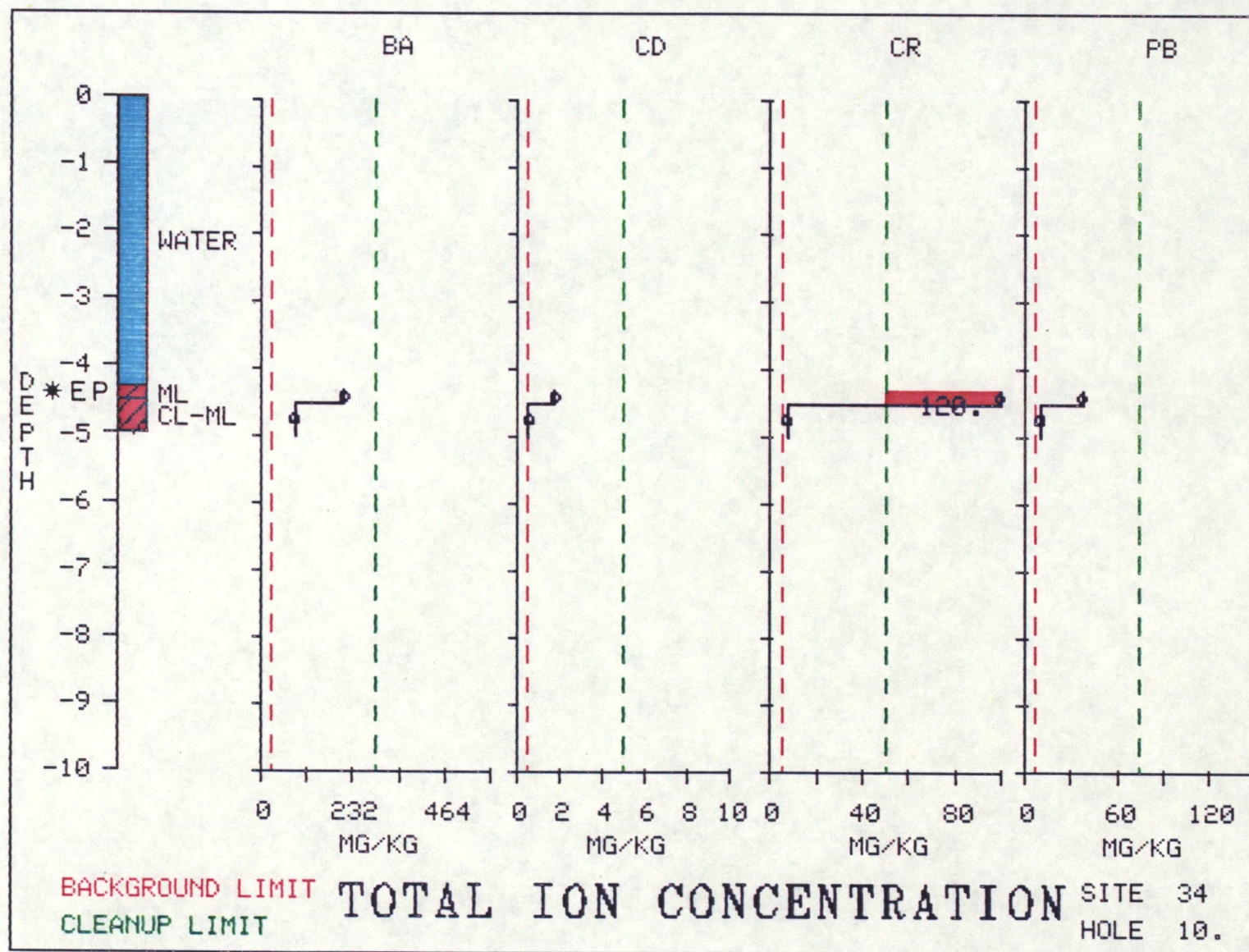


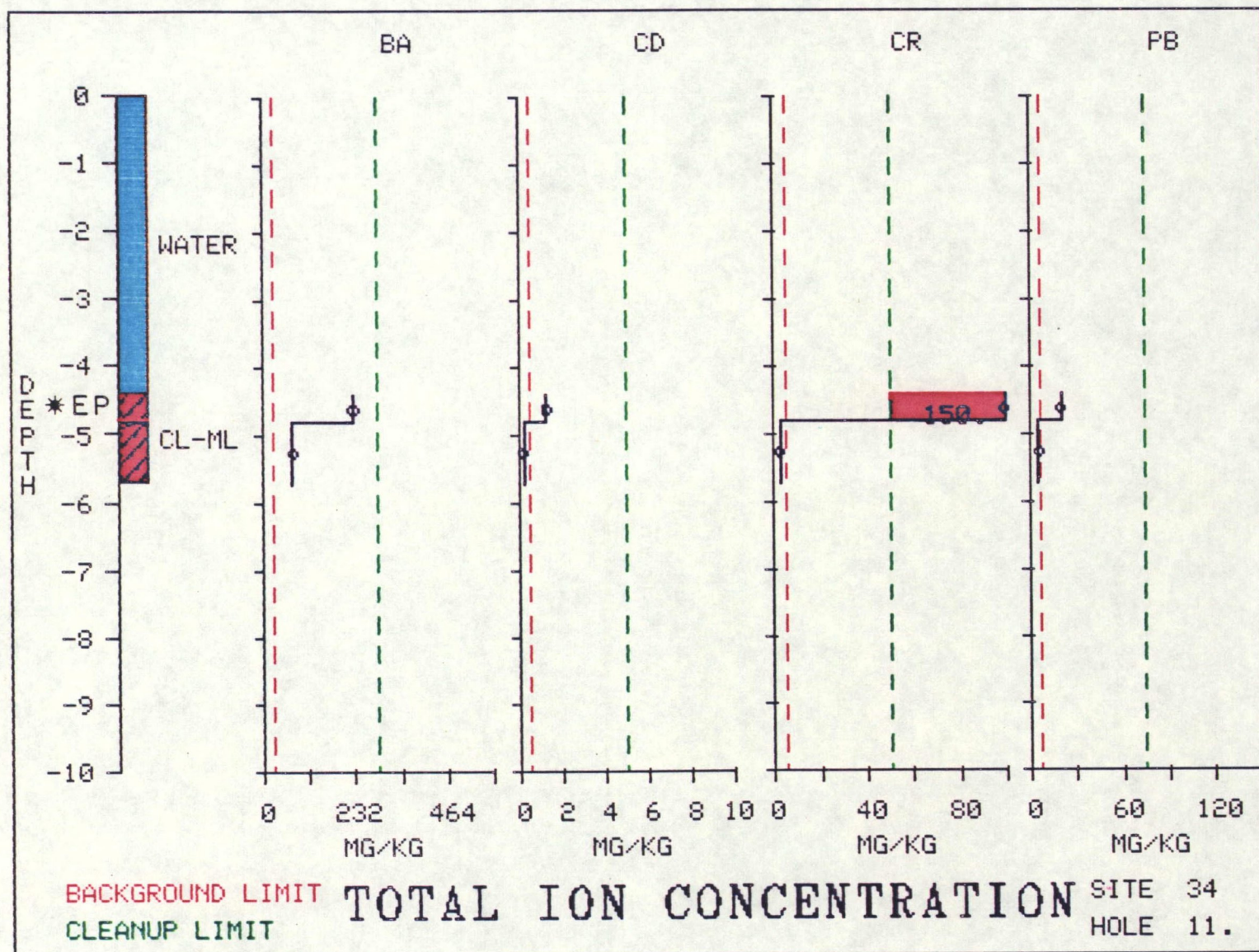




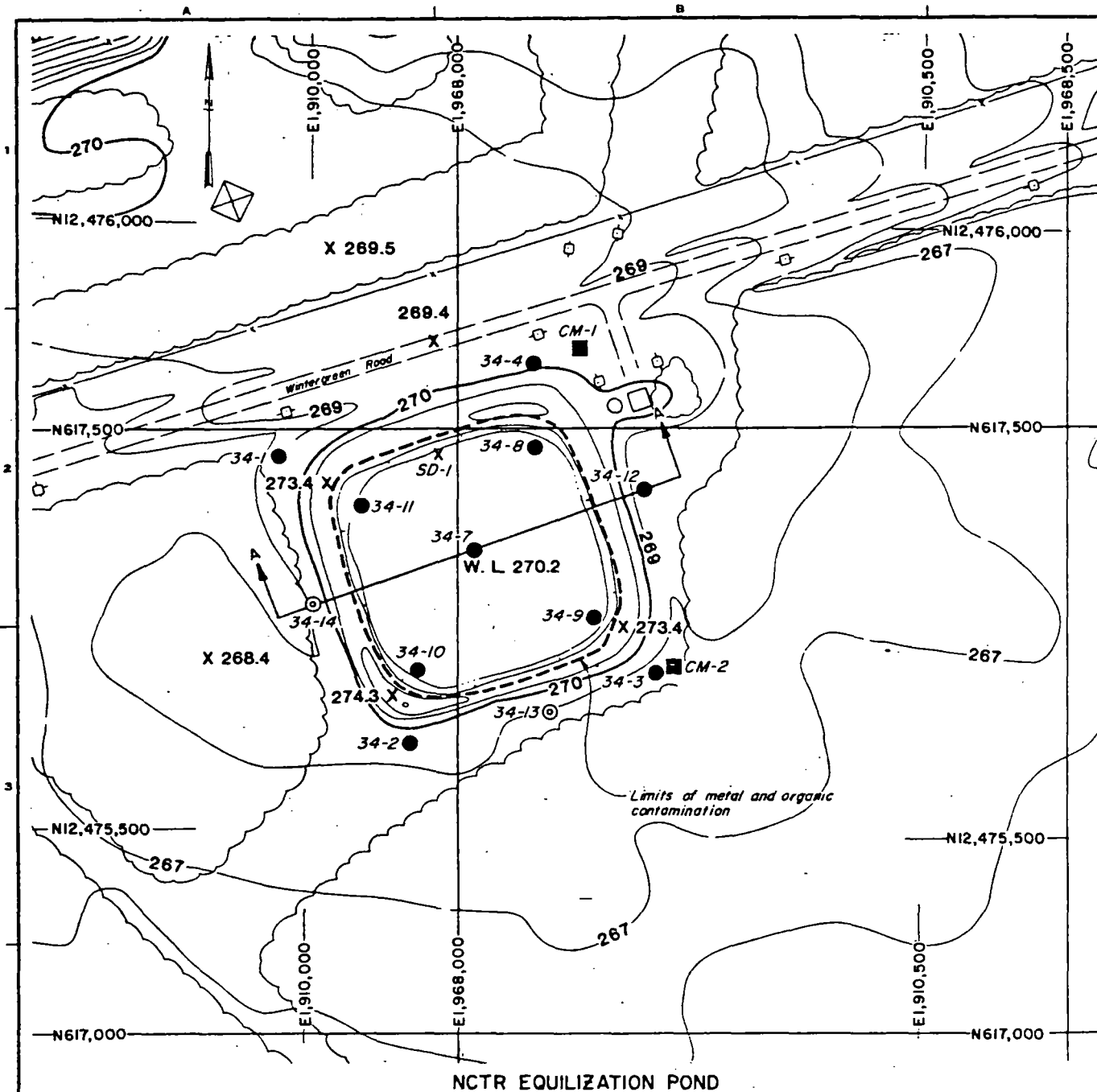




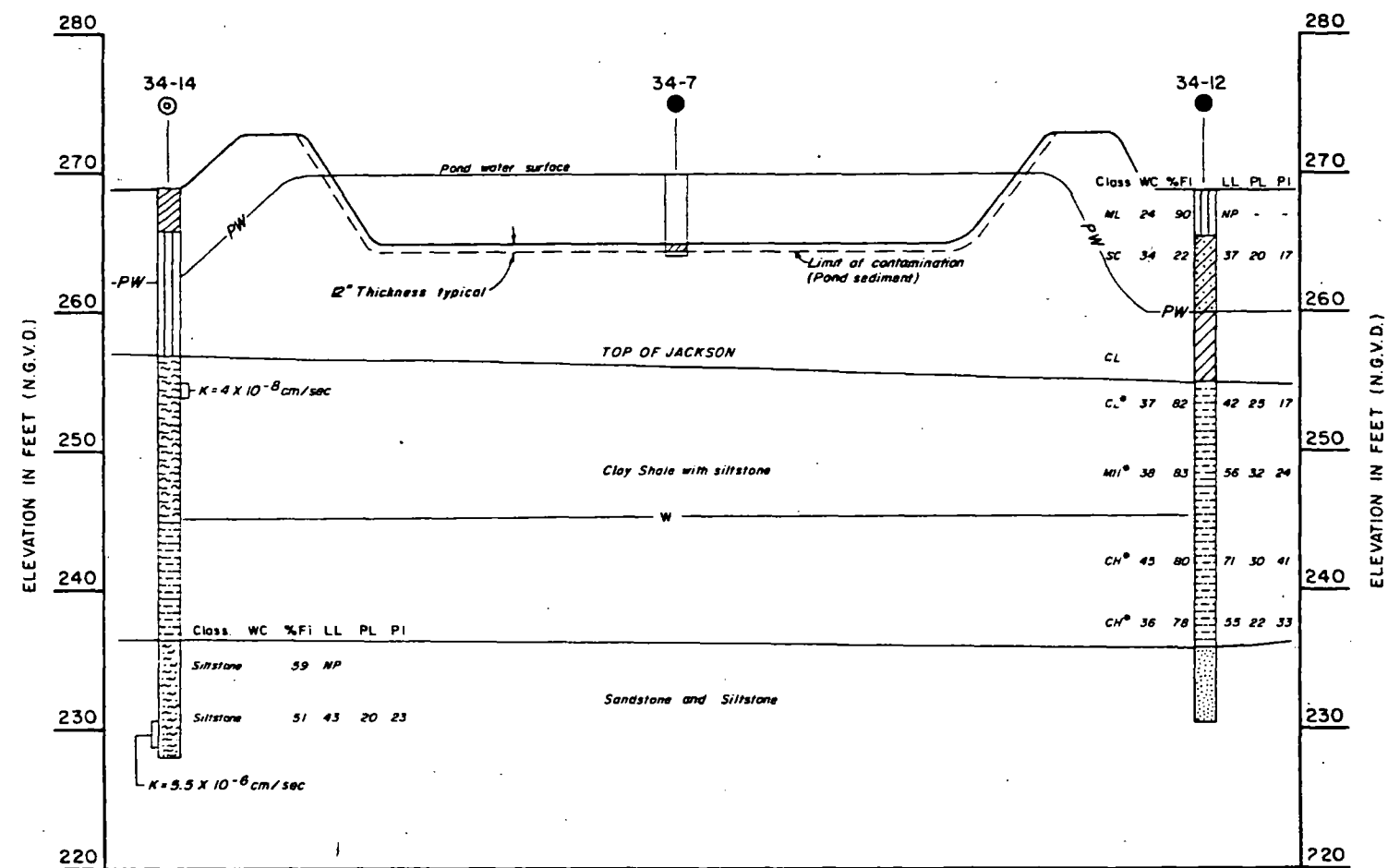
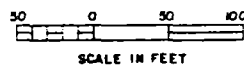




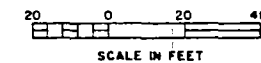
DRAWINGS



NCTR EQUILIZATION POND



SITE 34 - GEOLOGIC SECTION A-A



LEGEND

- ⊙ DENISON HOLE
- AUGER HOLE
- CONTROL MONUMENT
- * SOIL CLASSIFICATION PERFORMED ON CLAY-SHALE
- W- WATER TABLE
- PW- PERCHED WATER
- LIMITS OF CONTAMINATION
- X SEDIMENT SAMPLE

- CL, LOW PLASTICITY CLAY
- SC, CLAYEY SAND
- ML, CL-ML, SILT, CLAYEY SILT
- SM, SILTY SAND
- SAND
- CLAY-SHALE
- CLAY-SHALE WITH SILT
- SILTSTONE

- $K=3.1 \times 10^{-8}$ Permeability, cm/sec, from field test in zone indicated
- $K=3.1 \times 10^{-8}$ Permeability, cm/sec, from laboratory test on sample from zone indicated
- Class UNIFIED SOIL CLASSIFICATION SYSTEM
- WC WATER CONTENT
- LL LIQUID LIMIT
- PL PLASTIC LIMIT
- PI PLASTICITY INDEX
- %FI PERCENT FINES

KEY	DATE	CHANGE	REVISION (INDICATED BY Δ)	APPR.
DEPARTMENT OF THE ARMY TULSA DISTRICT CORPS OF ENGINEERS TULSA, OKLAHOMA				
DESIGNED BY:	PINE BLUFF ARSENAL PINE BLUFF, ARKANSAS PH: 83			
DRAWN BY:	HAZARDOUS LANDFILL/CLOSURE SITES			
CHECKED BY:	SITE 34			
SUBMITTED:	PLAN OF EXPLORATION AND SECTION			
CHIEF:	INVITATION NO. DACW56-8-00			
DATE:	SCALE: AS SHOWN			
	DRAWING NUMBER			